SCIENTIFIC AMERICAN

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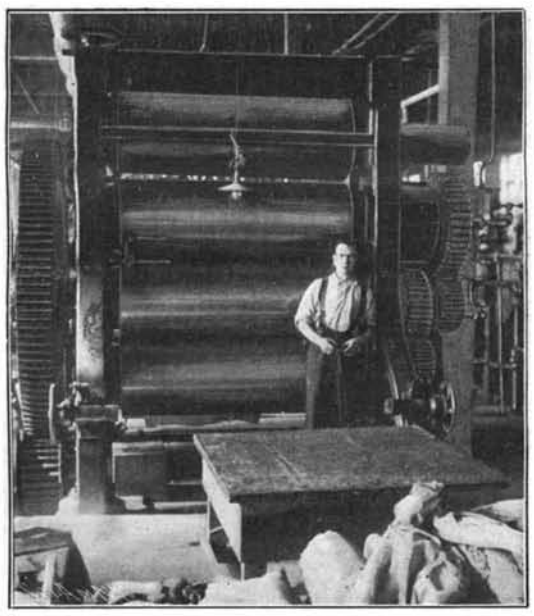
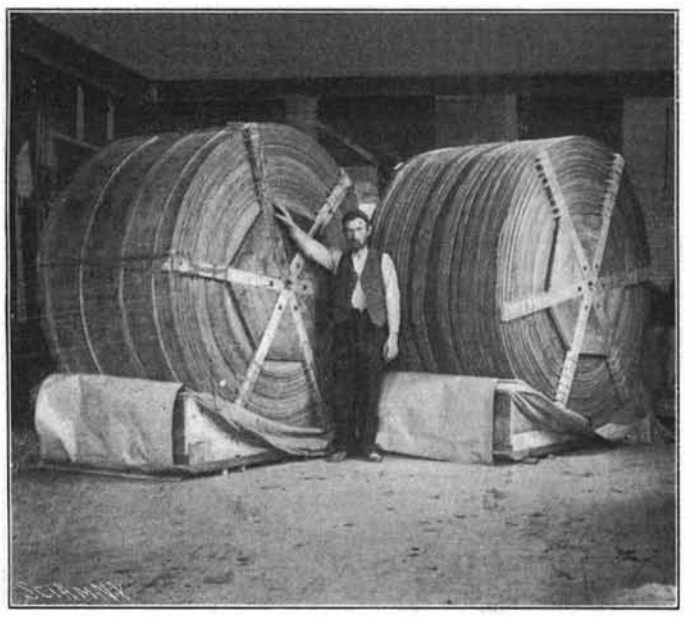
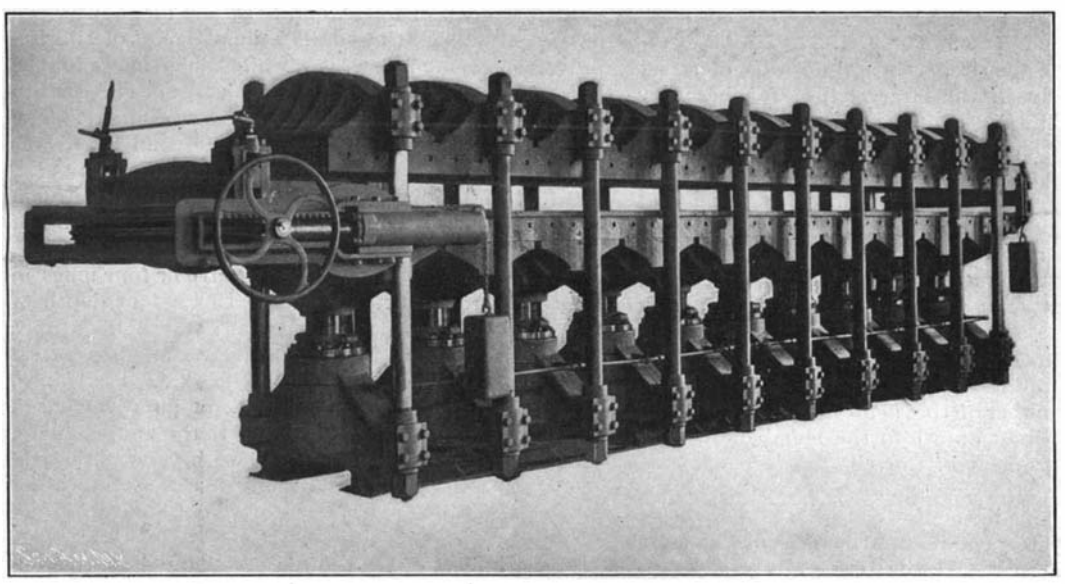


The "Calender," by which the Rubber is Rolled into Sheets, or Pressed into Woven Fabrics, Making Rubber Cloth, etc.

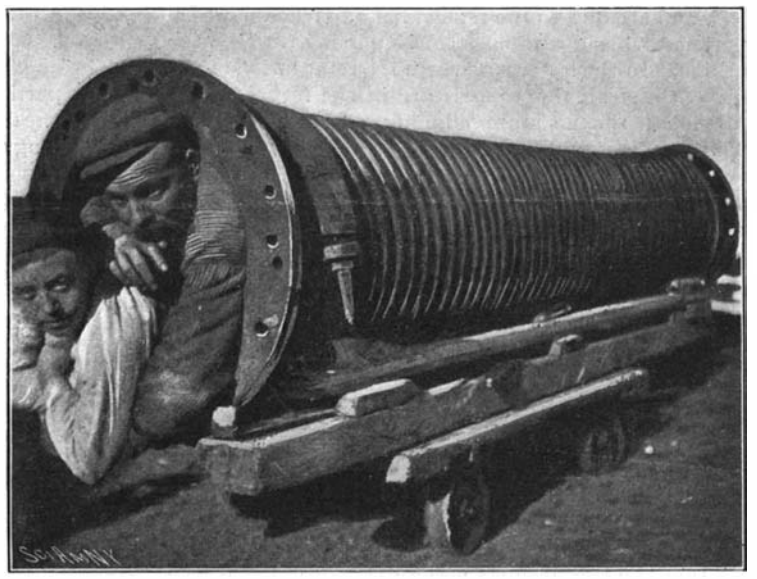
Pile of Huge Dredging Sleeves, Used as Flexible Connections Between the Pontoons that Carry Dredging Pipes.



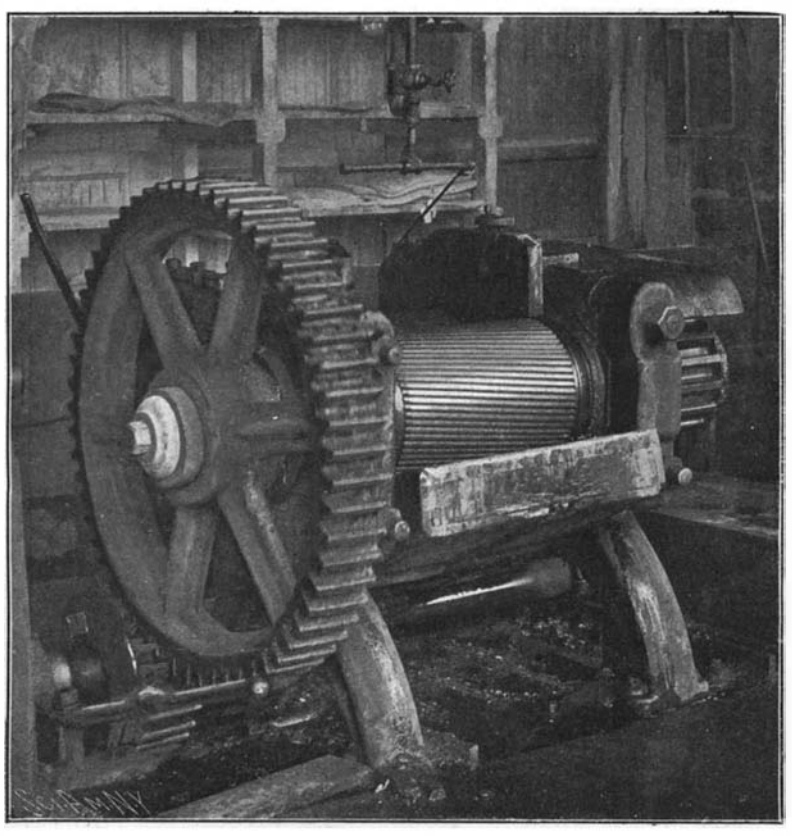
Two of the Largest Rubber Belts ever Manufactured.



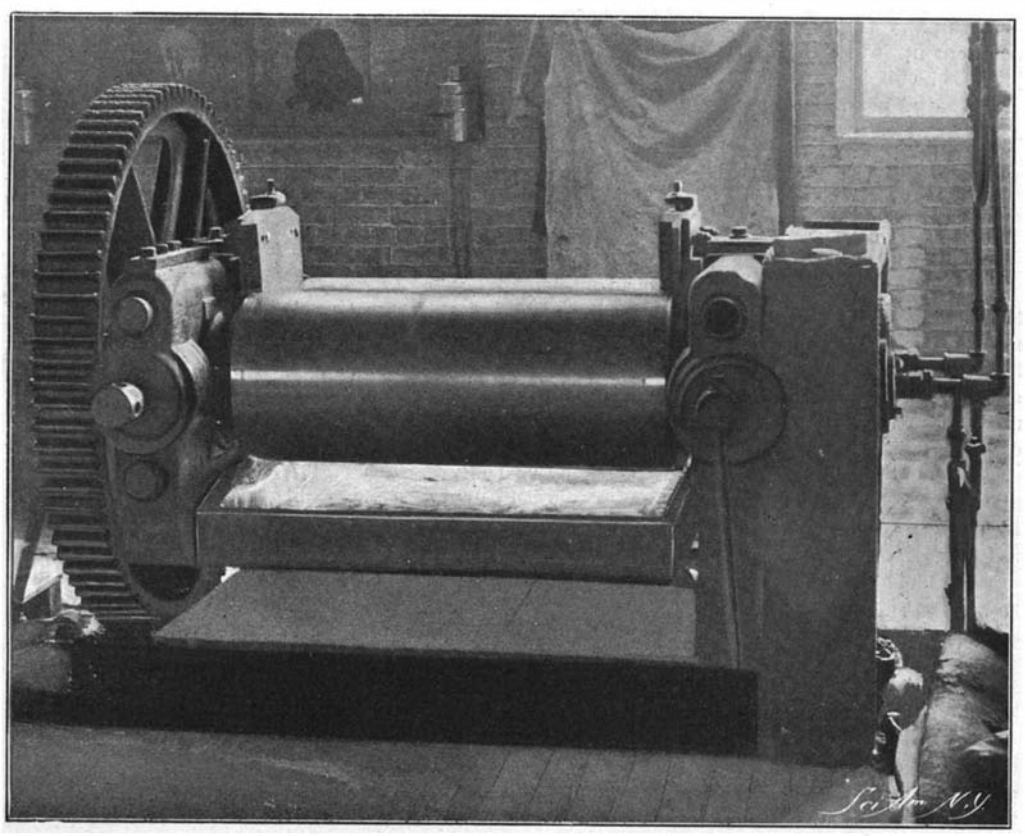
Hydraulic Belt-Press, in which Rubber Belting and Packing are Vulcanized Under Heavy Pressure.



Huge Piece of Suction Hose, Representing Effective Combination of Steel and Rubber.

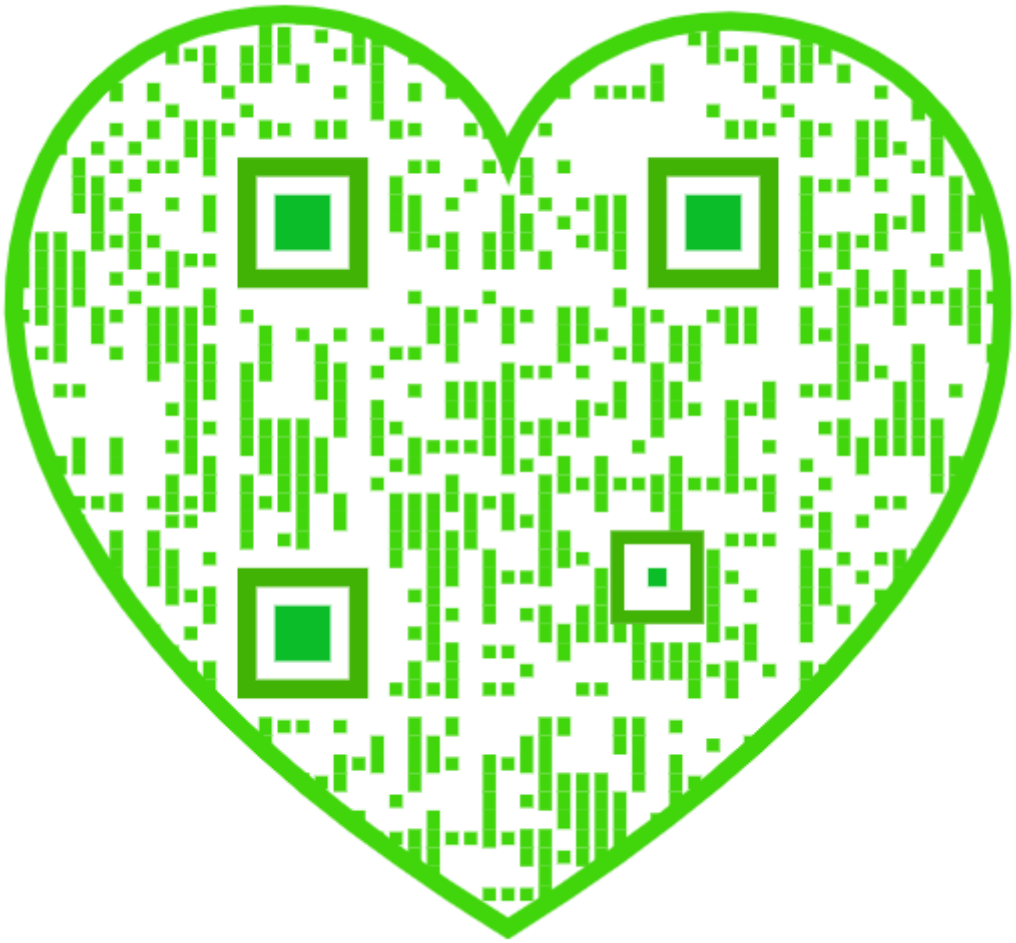


The "Washer," for Extracting the Sand and Other Impurities in the Crude Rubber.



The "Mixer," in which the Rubber is Formed into a Homogenous Mass, and "Compounded" with Various Ingredients.

THE MANUFACTURE OF MECHANICAL RUBBER GOODS.—[See page 102.]



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NEW YORK, SATURDAY, AUGUST 18, 1900.

ECONOMIES OF SUPERHEATED STEAM IN THE STEAM TURBINE.

The excellent results obtained with the best types of steam turbines are due in no small measure to the fact that they are not subjected to the cylinder condensation which is a fruitful source of loss in the ordinary reciprocating engine and the forms of rotary engines not of the turbine type. When the steam turbine is steadily at work the interior surfaces are at virtually constant temperature, and, for this reason, it might be supposed that the only gain which would result from the use of superheated steam would be that due to the increase of thermodynamic efficiency, corresponding to the wider range of temperature. It seems, however, that in the course of investigations carried out at Sibley College, it has been found that there is an actual gain of about 1 per cent for every 3° Fahrenheit of superheat, which is accompanied by an increase in the capacity of the turbine of about 100 per cent for 37° Fahrenheit of superheat. It is considered that the causes of each of these gains from superheating are identical, and are due to the removal of the friction which is present when saturated steam is passing through the turbine. In the latter case there is a retardation of the flow of the steam due to moisture in the form of drops and mist, the moisture clinging to the walls of the steam passages within the turbine. This explanation is corroborated by the fact that the gain, as far as the experiments have gone, is about proportional to the amount of superheating. Sibley College is to be congratulated on this the latest of many valuable truths which have been disclosed as the result of the careful investigations carried on under Prof. Thurston by this famous engineering school.

TOOL STEEL AT THE BETHLEHEM STEEL WORKS.

What is probably one of the most extensive tests of tool steel ever carried out has recently been made in the shops of the Bethlehem Steel Company. A special lathe was set aside for the purpose of experimenting with tool steel of different makes, with a view to the selection of a standard for use, and several picked men were set to work testing the relative merits, not only of the different tool steels then in the shop, but of all brands of established reputation. We are informed by the company that over 200 tons of steel forgings have been cut up into turnings on this lathe, and that over $100,000 has been expended in labor and material alone in developing a new process for hardening tool steel. The results of the investigation are of a very surprising kind, as may be judged from the fact that the introduction of this process has enabled the company to speed up the main lines of shafting from 90 to one of 250 revolutions per minute. As the result of careful records, made from time to time of the average amount of metal cut per hour, per tool, throughout the shop, it was found that the cutting speed had risen from 8 feet 11 inches in October, 1898, to 25 feet 3 inches in January 15 of this year, a gain of 183 per cent; and that the pounds of metal removed per hour had risen from 31 in 1898 to 137 in 1900, a gain of 340 per cent.

The virtue of the new process lies in the fact that it gives to the steel the valuable property of retaining a high degree of hardness even when heated to a visible red heat, "it being possible with one of these tools to cut steel at a speed so great as to heat up the point of the tube to redness, and have it continue to cut for several minutes at this speed, leaving an unusually smooth finish on the work as well as cutting accurately as to size." We are informed that the effect of the new hardening process, which is applied after the tool has been dressed on the machine to shape, penetrates to the center of the steel, even in the case of tools used in the Bethlehem shops which are 4 inches square in section. While the standard brands of self-hardening steel are improved more or less by this treatment, it is preferred to use a steel of special composition in order to get the maximum results. We are free to confess that the facts as given above would be sufficiently startling to raise a doubt as to their accuracy, had they come from any authority less qualified to speak on the subject than the company in whose shop the tests were made.

CHINESE ARTILLERY AND THE PRESENT CRISIS.

There would have been less astonishment expressed at the strength of the resistance developed by the Chinese troops if the public, and, indeed, in some cases the military authorities themselves, had borne in mind the fact that for over thirty years China has been making rifles and heavy cannon in her own arsenals and under the supervision of European officials. The Engineer, of London, has recently republished an article which was written in 1898 by a correspondent who had recently paid a visit to the Kian-Nan Arsenal, near Shanghai. These works have been under foreign control since 1870, and they employ 2,500 men. They are equipped for making magazine rifles, rapid-fire guns of small caliber, and heavy ordnance up to 12-inch bore. A number of fifty-ton 12-inch guns of the Armstrong pattern have been manufactured there during the past ten years. The correspondent states that all of the product, whether it was in the shape of rifles, machine guns, heavy ordnance or complicated gun carriages, had the appearance of being of excellent quality. "Annually for many years past large quantities of war material have been turned out here, and what becomes of it nobody knows. It is somehow absorbed, I am told, without the defenses of China appearing to be strengthened by the process." The allied forces know by bitter experience what has become of much of this Chinese-made war material, and there is no question that those thirty years of work in the Kian-Nan Arsenal will prove to be a most potent factor on the Chinese side in determining the course of the portentous events which are now transpiring in northern China. There is no question that the small-bore rifle and the machine gun are great levelers of the vaunted superiority of the so-called civilized over uncivilized races. Great Britain has found this to her cost in South Africa, and the allied forces are learning the same lesson in the valley of the Peiho.

A SUGGESTION AS TO STREET SIGNS.

The question of the size, style and position of street signs, particularly in the larger cities, touches very closely the daily life and comfort of the citizens; while to the visiting stranger the provision of conspicuous street signs is a positive necessity whether his stay in the city be for business or pleasure. We sincerely hope that there are no large cities in this country that are worse supplied in this respect than New York. During the Strong administration a serious, and, as far as it went, very successful attempt was made to supply New York city with suitable street signs, and many of the principal thoroughfares were equipped throughout with special sign-lampposts containing the name of the street and the number of the nearest house or building. For reasons best known to the members thereof, the present government of the city has seen fit studiously to ignore this admirable provision, and the sign-lampposts have been allowed to fall into disuse or decay, until probably one-half of them are now missing from the street corners. If the present city administration is anxious to obliterate these street signs, the least they can do is to offer some decent substitute in their place; and they surely would not have to seek far for a suitable sign. We notice in a recent issue of Municipal Engineering a letter from Mr. C. H. Topp, City Engineer of Victoria, B. C., stating that that city is making use of large letters, countersunk into the concrete walks within the stone curb, the name of the thoroughfare being inserted parallel with the street, and within a few feet of the corner. The device has obvious advantages, and if it were used in conjunction with elevated signs, it would afford all the direction that could be desired. Although sidewalk signs would scarcely be sufficient to meet the necessities of street-car travelers, they would form a very effective sign for pedestrians.

THE LEADING RAILWAY SYSTEMS OF THE UNITED STATES.

The process of absorption of smaller concerns by large corporations is fully as marked among the railroads as it is among the great manufacturing industries. The growth in mileage of the largest roads is truly phenomenal, and it will surprise our readers to learn that upon this continent there are three separate systems, each of which has a total mileage which is almost half as great as the total mileage of Great Britain. The largest aggregation controlled by any one company is that of the New York Central Railroad, which totals 10,410 miles; making a very close second is the Pennsylvania system with 10,392 square miles, while the great Canadian Pacific Overland route and connections total 10,018 miles. Another trans-continental line of almost equal size is the Southern Pacific, which owns and controls 9,362 miles. There are four companies controlling from 7,000 to 9,000 miles; seven companies controlling from 5,000 to 7,000 miles; three companies from 3,000 to 5,000 miles, and nine companies controlling from 2,000 to 3,000 miles of track, the total mileage controlled by twenty-eight companies being nearly 150,000 miles. Of the five great trans-continental companies, the Canadian Pacific and the Southern Pacific with over 10,000 and 9,000 miles respectively are by far the largest. The Atchison, Topeka and Santa Fe comes next with 7,880 miles, followed by the Union Pacific with 5,584, the Northern Pacific with 5,449, and the Great Northern with 5,201 miles of track.

THE ENTRANCE TO THE MISSISSIPPI RIVER.

It is a fact, perhaps not generally known, that one of the principal objects which led to the purchase of Louisiana in 1803, was to obtain control of the outlet to the great central basin of the Mississippi River with its 15,000 miles of navigable waterways. Commencing in 1837, the government of the United States made at different times more or less serious efforts to increase the depth of the channels at the delta mouths, which ranged from 8 to 15 feet. The results obtained, however, were not permanent. It was in May, 1875, that Congress awarded a contract for the deepening of the Southern Pass to the late Captain James B. Eads, for a sum of $5,250,000, payments on which were to be made only as results were secured. In the face of natural difficulties and political opposition, which would have staggered a less resourceful and resolute man, Captain Eads verified the correctness of his theories by securing a channel 26 feet deep and of 100 feet surface width. This channel has been maintained and is still available for navigation; but the twenty-five years' contract having now expired by limitation, and the draught and size of vessels having greatly increased in the interim, the country is confronted with the problem of immediately providing additional channel facilities.

On June 7 of last year, the Board of Engineers reported a project for securing a channel of 35 feet depth and adequate width through the Southwestern Pass of the Mississippi River. The plan consisted of two parallel, straight jetties, placed 2,400 feet apart, which were to commence on the seaward slope of the bar and in about 30 feet of water, and to extend for about seven miles up the pass, the total estimated cost of this improvement being $13,000,000, while the estimate for the extension of the jetties and for maintenance is equal to an interest of three per cent on $13,000,000 more. The plan being purely a tentative one, a second board was appointed, which on January 11 of this year advised that the main reliance should be placed upon dredging, assisted by a bottle or coffin-shaped plan of jetties which would aid in maintaining the channel. These jetties were to be about three or four miles in length; were to extend out to the 20-foot depth of water on the outer slope of the bar; and their distance apart was to vary from 7,000 feet at their greatest diameter to about 3,000 feet at the seaward entrance. It is evident that a national work of improvement of this magnitude, costing, according to the first estimate, $26,000,000 for construction and maintenance, should receive, as regards its engineering features, the fullest investigation before a pile is driven or a yard of sand removed.

The problem of maintaining a channel at the entrance to a river like the Mississippi, which brings down annually and deposits at its mouth enormous volumes of sand, has been the subject of a vast amount of study and careful experiment by engineers who, like Captain Eads, have made a specialty of this class of work; and the elements of the problem are fairly well understood by the public at large. As long as the effluent waters maintain a certain velocity, the silt is carried along in suspension; but as soon as the outflowing waters spread out at the river mouth, the current becomes slack and the silt is deposited, choking the channel and reducing its navigable depth. The contour of a natural channel, such as the Southwestern Pass of the Mississippi, shows a decreasing depth until a minimum is reached at the crest of the bar, which will usually be found extending approximately at right angles to the course of the channel, and parallel with the sea-coast. After passing the crest of the bar, the depths decrease somewhat rapidly to deep water. The object of parallel jetties is to confine the effluent water and cause it to flow with sufficient rapidity to keep the silt in suspension until it is carried past the mouths of the jetties and out to deep water beyond the bar. Unfortunately, a parallel jetty system fails in two particulars. In the first place, it merely pushes back the bar further seaward, necessitating the constant extension of the jetties to cut through the fresh bar thus formed; and, in the second place, it not infrequently occurs that an inner bar is formed within the jetties themselves.

We have recently received from Professor Haupt, whose work in connection with rivers and harbors is well known, a pamphlet in which he suggests an alternative scheme for the Mississippi River improvement which is well worthy of consideration; particularly as its principles are based upon the laws which govern the conformation of the natural bars and channel ways of rivers. The whole paper, which is accompanied with illustrations and diagrams, is published in the

current issue of the SUPPLEMENT, and only a brief description of the principles advocated is possible here.

According to Mr. Haupt, there are other agencies at work in a stream besides the mere volume and velocity, which tend to create and maintain deep channels, as may be seen by a study of the bed of the Mississippi River at the delta. It is found that wherever the course of the river passes from a tangent to a curve, there is an immediate increase in the depth of the channel, which will be found to follow closely the concave bank. Not only is a deep channel formed close to the concave bank of the river, but the silt is thrown over to the convex shore, which shallows gradually from the point of greatest depth to the opposite bank. The sand is continually being washed out from one side of the river, and thrown up on the other. It is claimed by Mr. Haupt that if these natural conditions were reproduced at the Southwest Pass by building a single jetty with a curve of normal radius, the same results would be obtained. The outflowing and inflowing water impinging upon the jetty would maintain a constant depth of water in its proximity, and the surplus water would flow at reduced velocity over the collateral bank, depositing the silt and forming a shoal which would answer the purpose of an artificial jetty. "A single, concave, curved jetty so placed as to encroach gradually upon the path of the stream, produces a compression which causes deflection of the water and deep erosion of the sand, thereby creating a channel parallel to the axis of the jetty, and also building a natural levee by the lateral transportation of displaced material."

The proposed jetty would start from the eastern point of the Southwestern Pass; and would extend nearly two miles in a practically straight line, parallel with the axis of the flow of the river, and at a proper distance from it; thence it would curve to the northwest, with a radius of 4½ miles, for a distance of about 2 miles and end at the 30-foot depth of water on the outside of the bar.

It is estimated that the depth of water which would be attained by a reaction jetty of this type would be 40 feet. Having in view the enormous cost of either of the plans suggested by the Boards which have reported upon this project, there can be no question of the superior economy of Mr. Haupt's single-jetty system. If, after the jetty was completed, it was found that, owing to unexpected conditions outside the river mouth that did not exist in the river itself, the reaction theory did not hold, it would still be possible to obtain all the advantages of the other system by building another jetty parallel, and concentric to the first. It is not likely that if it were found necessary to complete it as a double jetty, the slight curvature would produce any harmful effect upon the structure.

IRRIGATING THE SUGAR PLANTATIONS OF HAWAII.

Sugar is the paramount staple of the Hawaiian Islands. In 1898 the amount produced equaled 2,224,825 short tons, and with the opening of projected new plantations the production will be doubled. With the absorption of the country by the United States, and continuance of the present commercial conditions, the industry is favorably affected. There are now forty-nine incorporated companies, with a paid-up capital of $68,812,000.

The Hawaiian Islands are peculiarly adapted to the cultivation of the cane. The climate is semi-tropical. The soil, volcanic, of exuberant fertility, and the rainfall—an essential feature—copious and fully adequate to the enormous requirements of the plant; the quantity necessary for the cultivation of the sugar cane is prodigious. Upon the Oahu plantation, near Honolulu, there are thirty-six artesian wells, 12 inches in diameter, varying in daily capacity from 1,000,000 to 2,000,000 gallons, all required to supply the plantation of 10,000 acres. Every day 10,000,000 gallons are necessary for each 1,000 acres. Twelve vertical inches of water each month have to be pumped on these thirsty fields, which have to be flooded every ten days. The present yield of this plantation yearly is 18,000 tons, which ultimately will be increased to 40,000 tons.

Though the annual rainfall of the island of Oahu is 70 inches, dependence is placed upon the wells alone. The soil of all the islands has a foundation of porous, volcanic rock, over which has been deposited seven or eight feet of loam, the product of ages of decaying vegetation. It is consequently easily drained and quickly absorbs the heaviest rainfall. A few hundred feet below the surface are inexhaustible supplies of water, and at no time have the wells failed to pour forth their wonted streams or to become reduced in their normal level. Even when the surface rainfall has been less, the wells have never yet been affected in the least.

Taking three of the best known plantations of the island of Oahu—Oahu Sugar Company, Ewa Plantation, and Waialua Agricultural Company, aggregating 50,000 acres—the total number of pumping plants are 24; wells, 108; and the daily amount of water required, 196,000,000 gallons, pumped to a height of 550 feet in some instances, and from that down to levels as low as 60 feet. In the island of Oahu there are altogether 209 artesian wells, supplying yearly 44,000,000,000 gallons, and scientific calculations prove that, deducting the natural loss from surface drainage and evaporation from the 600 square miles of the island, at least four-fifths of the yearly surface rainfall passes away without rendering any service to agriculture whatever.

The opening up of the new Olaa plantation, on the island of Hawaii, has demonstrated the existence of huge reservoirs on the slopes of the volcanoes of Mauna Loa and Mauna Kea, from which an immense and inexhaustible flow of water is to be obtained. The plantation embraces 19,500 acres, located on the east side of the island, and encloses a strip 4 × 15 miles in dimensions, at an altitude ranging from sea level to a height of 2,000 feet. The average annual rainfall varies from 160 to 200 inches. Along the slopes are found swampy places, where the interior waters have appeared above the surface, and occasionally flowing springs, suggesting hidden sources of water supplies. Exploration revealed a promising site for tunneling into the side of the mountain, and soon a great increase in the flow was encountered.

The use of dynamite demolished the walls of the reservoirs, and great floods of water resulted. No. 1, tapped May 15 of the present year, has regularly supplied 5,750,000 gallons daily, and No. 2, 4,250,000 gallons. United, these streams will be conducted to the mill of the plantation by a flume and used in transporting cane from the highest portions of the plantation to the site where it is manipulated, a distance of 15 miles.

The enormous rainfall of the island of Hawaii, compared with others of the group, is easily explained. The evaporation is great, and the humid air, driven by the prevailing northeast trades against the lofty range of mountains, of which Mauna Loa, 13,675 feet, is the dominating summit, is condensed by the extreme cold of these high altitudes and falls to the ground. The reservoirs are great bubbles in the earth formed during volcanic eruptions.

The discovery of these water reservoirs has greatly stimulated sugar planting in Hawaii.

NEW FORM OF CELLULOSE.

A new form of cellulose has been recently discovered, which possesses many valuable properties. The chemical designation of this new body is the soda salt of cellulose—xanthogenic acid; it is often designated by the name xanthate of cellulose, or viscose. The discovery of the body is due to the researches of Messrs, Cross, Revan and Beadle, the fundamental action being that of the alkali upon cellulose; these have no action if they are sufficiently diluted with water, and have no other effect than that of bleaching the cellulose; when concentrated, however, they act energetically and give a well-defined compound of cellulose and alkali. In order to obtain the viscose from an alkali-cellulose, the latter must be submitted to the action of carbon disulphide. A combination is formed, and the body at first swells up, being converted by degrees to a gelatinous mass, which gives a homogenous solution in water. The process is thus very simple; the cellulose is triturated in a mortar, while still somewhat wet and in short fibers, with soda lye, which is poured in little by little. The matter is then placed in a closed vessel with a small quantity of carbon disulphide for three or four hours, to obtain the viscose. This body somewhat resembles glue in appearance, being more or less thick, according to the quantity of water it contains; it is remarkable for its viscosity, whence its name. It is strongly colored, but the coloration may be changed by the addition of pigments. The property of viscose which makes it of especial value, is that at the end of a certain time, often but a few hours, it forms an insoluble gelatinous mass, which becomes comparatively hard and washes perfectly. It may be moulded into different forms or spread in a thin layer upon wood, paper, fabrics, etc. The various uses of this product are apparent; the insolubility of the varnish may be increased by dipping it into a concentrated solution of salt, alum, etc. It is probable that viscose will render service in the fabrication of artificial leather or vegetable silk.

INTERNATIONAL MINING CONGRESS.

One of the most interesting of the international congresses held at Paris has been that relating to mines and metallurgy; its president was M. Haton de la Goupillière, Inspector-General of Mines. The opening and closing sessions were held in the Palais des Congrès of the Exposition, and the remainder at the rooms of the Société d'Encouragement de l'Industrie Nationale. A large number of delegates from the different nations were present, and from an industrial point of view the results of the congress have been considered of great importance. In the opening address the president referred to the great progress realized in the metallurgy of iron and steel, and co-operation of the different sciences in the final results, of which the expression was to be found in the numerous reports which had been prepared to serve as a base for the discussions. Among the papers of especial interest may be mentioned that of Prof. Weddind, of Berlin, who treated the magnetic separation of ores. M. Hubert, Chief Engineer of the Belgian railroads, gave the results of the progress accomplished in the direct use of blast furnace gases in the production of motive power. M. Babu, Professor at the Paris School of Mines, showed what had been realized in the manufacture of special steels with manganese, chromium, nickel, etc. A remarkable study was presented by M. Hartmann, Chief of the Artillery Works near Paris, relating to the phenomena which accompany the deformation of metals when worked. The different studies of coke furnaces are worthy of note, and those on the mechanical installation of metallurgical works, transportation of slag, methods of charging and discharging raw material and products, the use of electricity in mines, and others. M. Bousquet, a prominent engineer of the South African region, made a communication of great interest on the progress of the metallurgy of gold and the cyanuration of ores in the Transvaal. In order to handle the large amount of material which was presented, the congress was divided into special sub-sections for the study of the various mining and metallurgical questions; the reports on the different subjects were prepared in advance, in order to give an exact basis for the discussions and to limit them to the essential points. The resumé of the reports and discussions of the congress will give an exact account of the present state of these industries.

DEATH OF DE WITT CLINTON HASKIN.

DeWitt Clinton Haskin died July 17, 1900, at Buffalo, N. Y. He was born in 1824 and after varied adventures in his early career, he started to build the California Pacific Railroad line, connecting the city of Marysville with San Francisco; a short line connected Sacramento with the main line. He then built the California Pacific Railroad line, which was completed in 1869, after which he became engaged in mining in Utah. In 1872 he came to New York and while crossing the Hudson River during a fog he realized the advantages of a tunnel under the Hudson. He immediately began operations for the construction of such a tunnel, the nature of the material being a fine quicksand silt. He found that methods different from those adopted at that time would have to be used. He conceived the idea of utilizing compressed air to balance the weight of the water and silt until masonry could be put in. He then took out patents covering the pneumatic process. His idea at that time met with great opposition by those familiar with tunnel construction. After years of persistent effort Mr. Haskin demonstrated that his plan was practicable, although the work was never completed, owing to financial complications.

CAVIAR.

Two distinct varieties of caviar are manufactured in Russia, the granulated and pressed forms. The granulated form is obtained by passing under pressure through a fine-meshed sieve; the small eggs pass intact, but the envelops are retained in the sieve. To these pure salt is added in the proportion of $\frac{1}{20}$ or $\frac{1}{40}$; it is intimately mixed with the eggs by means of a kind of wooden spoon. The caviar is then ready for consumption; it is packed in round metallic boxes of 1½ to 5 pounds, enveloped in parchment for transportation. The pressed caviar keeps better than the granulated form. To obtain it the fresh caviar is treated with a solution of salt at 25° Baumé until the eggs have acquired a certain degree of hardness. This operation requires considerable skill and experience; if allowed to stay in the solution too long, the caviar will be too salty, and if not long enough, the eggs cannot be preserved. The caviar is then put into small sacks, which are pressed under a screw-press to drive out the excess of salt. It is packed in barrels containing up to 1,000 pounds, or left in the original sacks, which measure 8 by 20 inches. The average export of pressed caviar for the three years, 1896 to 1898, has been more than 3,000 tons, representing a value of $1,400,000.

TELEGRAPH LINE IN GERMANY.

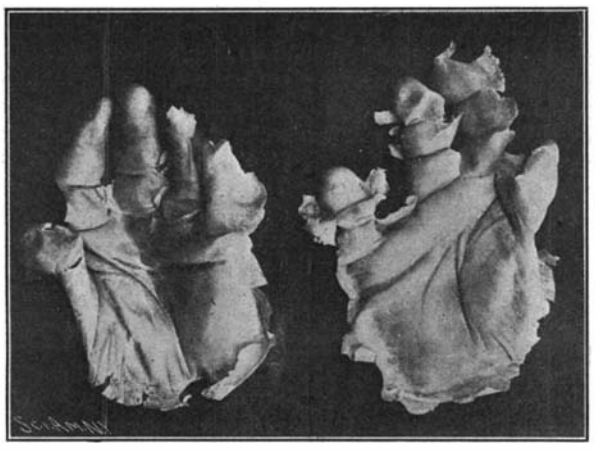
In Germany the establishment of a new telegraph line between that country and England has been considered, and an addition of $500,000 to the budget has been demanded for this purpose. Since the laying of the fourth cable in 1896 the number of telegrams has continued to increase, this number being 1,867,868 in 1895 and 2,465,613 in 1899. As a result, the crowding of the lines has been prejudicial to the commercial interests, and accordingly the establishment of a fifth line was found necessary. The new cable, of four conductors, will start from Borkum and end at Bacton, Norfolk; it will be constructed and laid in concert with the British telegraph administration, and will unite all the most recent improvements in the technique of submarine cables. The expense will be supported in common, except for the junction lines proceeding from the terminal stations, which will be borne by the respective governments.

A CURIOUS CASE OF SKIN-SHEDDING.

A resident of Clark County, Missouri, Mr. S. O. Buskirk, has shed his skin annually since his birth, which occurred in 1850. He is well-built, robust and agile, and was never ill. He takes very little medicine for the annual attacks when his epidermis is shed. Physicians have tried to prevent this exfoliation, but they have been unsuccessful, and Mr. Buskirk, notwithstanding the fact that the operation is disagreeable and debilitating, has decided that he will not make any more attempts to prevent it by medical means. The operation requires several days, and for the last five years has begun exactly on June 27. Prior to that time it came either in July or August. About a month is consumed in discarding the old cuticle and the appearance of the new. During this time the finger and toe nails become loose and are discarded, new nails come in, and more time is required in growing the nails to maturity than is ordinarily needed. After the old skin has been shed he says that he feels like a boy of eighteen. The discarded cuticle looks like thin, white rubber gloves.

Our photographs show the remarkable peeling of the hands. The peeling begins at the root of the fingers and gradually spreads in all directions. The hardened skin begins to break away from the new skin which is forming underneath, and if it is tapped with a lead pencil it gives off a sharp sound like that caused by striking a piece of celluloid or stiff leather. By opening and closing the hands often the skin parts along the edge, and then by helping along the process with a penknife, the piece comes off whole. He has several interesting souvenirs in the form of patches of skin which he has shed from his hands and feet at various times, and in every instance they present perfect outlines of the members from which they come.

The thick, callous-like skin from the hands retains its lines, and this remarkable case tends to disprove the entire theory of palmistry, being evidence that the lines of the hands change with time and are not unalterably preserved, as has been supposed. A piece of the skin taken from his right hand when he was ten years old shows that the general conformation of the lines correspond with those of his hand to-day. Still, the new lines are longer now than then, making allowance for the growth of the member as a whole. Fully a third has been attached to the length of the famous "life" line. Evidently nature had decided to increase Mr. Buskirk's span of life. This is not altogether surprising, as his father is now one hundred and three and his grandfather died at the age of one hundred and ten years.



A CURIOUS CASE OF SKIN-SHEDDING.

THE MARSH MOTOR CYCLE.

BY ALONZO R. MARSH.

The Marsh motor cycle, of which the accompanying photograph (Fig. 1) is a good illustration, weighs, when ready for the road, 60 pounds.

The motor, shown in the engravings Figs. 2 and 3, is of the four-cycle jacketless type, using gasoline as fuel. It weighs 20 pounds, is 14 inches high by 4 inches wide. The crank case is 7 inches in diameter. The cylinder is 1⅞ inches in diameter and 2¼-inch stroke. The outside or circumferential part of the crank case or base is an aluminium casting, carefully machined to receive the cylinder and the side disks. The latter are made of steel and contain the bearings. This base is fitted with a filler conveniently located on the front side above the center, through which the lubricating oil is admitted. It also has a drip in the bottom, through which this oil may be charged.

By looking at Fig. 2, which is a side view of the motor, it will be seen that the cylinder, which is made of cast-iron with the usual corrugations, is fastened to the base with six screws.

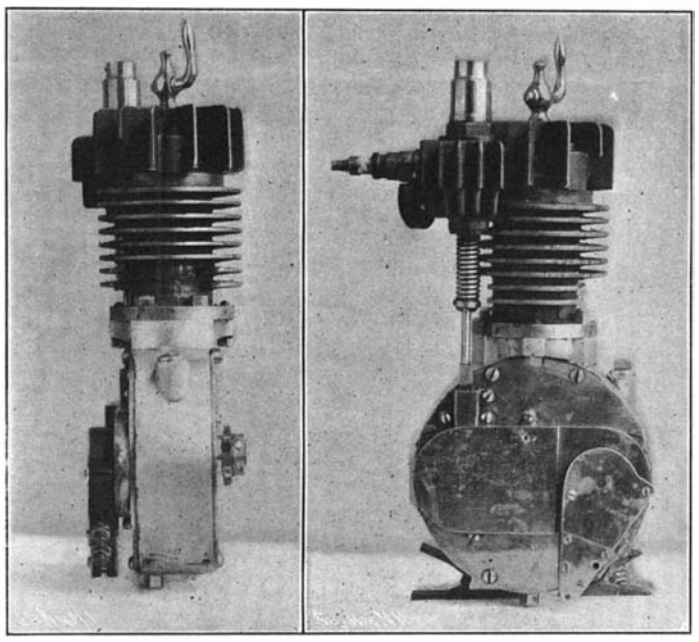
At the extreme left is the ignition plug, which screws into the combustion chamber. The fixture, which may be seen directly under the plug, is a lug by which the upper part of the motor is fastened to the seat post, and through which the exhaust passes on its way from the cylinder to the muffler. Directly on top of the combustion chamber may be seen the casing of the induction valve, which is nickel-plated, while directly under the combustion chamber may be seen the exhaust valve-stem and the spring which closes the same. The fixture on top of the cylinder is the compression relief-valve.

On the left-hand side of the motor are located the gear and cam for operating the exhaust-valve and also the ignition device. These are inclosed in an oil-tight case. On the left-hand side is the sprocket which drives the rear wheel. In Fig. 2 may be seen, on the left of the crank case, a flat projection. This corresponds to a lug on the seat post tube, and is tapped to receive four 4-inch screws, which is a part of the fastening that holds the motor in place. The great feature of this motor is the construction of its bearings, which are so arranged that it has a large amount of bearing surface and still is less than 4 inches wide over all, which permits of its being placed between the cranks of any ordinary road wheel.

By examining the photograph marked 1, the position of the motor is clearly seen, it being located in the angle of the frame in front of the seat post and just above the hanger sprocket. The motor resumes the same angle as the seat post tube, and is fastened to it at the back of the base and also at the back of the cylinder.

The pedal side of the rear hub is fitted with a coaster brake, the motor side being fitted with a 32-tooth sprocket, 1-inch pitch, and ⅜-inch wide. The sprocket on the motor has five teeth, which allow the same to revolve 6⅖ times to one turn of the rear wheel. As the rear wheel is 28 inches in diameter, the motor runs a little over 2,300 revolutions per minute when the cycle is making 30 miles an hour.

The valves and ignition device of this motor are correctly proportioned and carefully made, and with the chain removed from the motor, it will reach a speed of 5,000 revolutions a minute without missing an explosion. The motor chain may be adjusted by moving the rear wheel back and forth in the jaws in which it hangs, while the pedal chain is adjusted by turning the eccentric around in the bottom bracket.



Figs. 2 and 3.—DETAILS OF ENGINE.

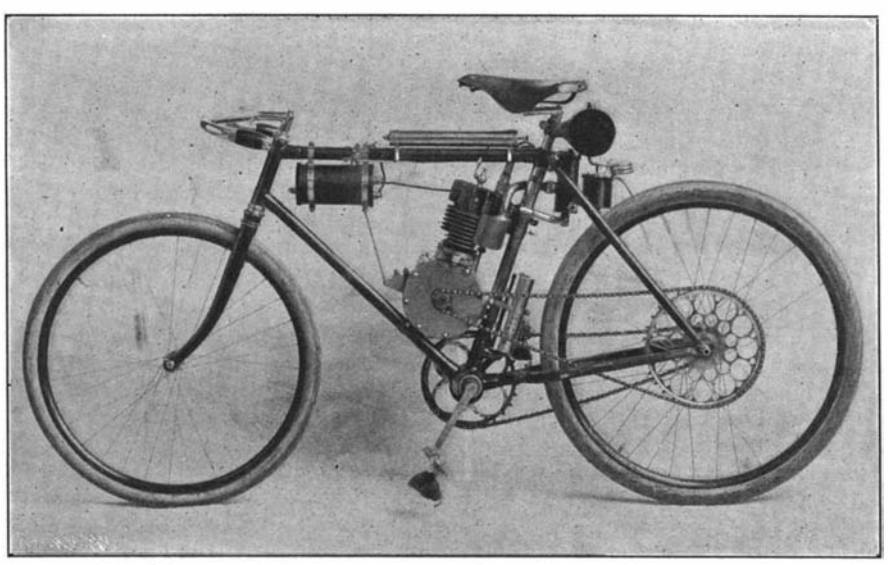


Fig. 1.—MOTOR BICYCLE.

The cylindrical box to be seen in the forward part of the frame is the spark coil, while the tube on the top of the frame, just forward of the saddle, contains four cells of dry battery, which are only 1 1/16 inches in diameter by 1⅞ inches long, and weighs complete, case and all, 1¼ pounds. A coil and a set of these batteries will last nearly 500 miles, which is an item that deserves some notice, as it saves carrying the bulky batteries ordinarily used, which weigh from 12 to 15 pounds.

On the rear of the saddle post may be seen the fuel tank, which holds a quart—the amount of fuel that we have found necessary to run nearly 100 miles. The fixture to be seen on the right-hand side below the fuel tank is the carburator, which is of the vaporizing type and is automatic in its operation. It can always be depended upon to give the right mixture of gas and air, and as much as the engine can use at all times. It is securely fastened to the seat mast by a suitable lug.

The fixture to be seen on the left-hand side of the cylinder is an air-scoop, which sends warm air to the carburator. At the rear of the seat mast, between the base of the motor and the rear wheel, may be seen the muffler, which is made from brass tubing, 2 inches in diameter and 7 inches long, and is lined with asbestos, being perforated with a number of small holes on either side. The muffler is very efficient, muffling the exhaust so that it can scarcely be heard. It will be noticed that the makers have used the seat post tube to convey the exhaust from the cylinder to the muffler, the exhaust passing into the tube from the cylinder through the fitting by which the upper part of the motor is connected to the frame. This saves the use of a separate exhaust pipe, which would be in the way, and help to make the machine appear complicated.

On the top tube, just above the spark coil, are located the handles by which the machine is operated, two in number, one on either side. The handle on the right-hand side is connected to the ignition timing device, as may be seen by a steel rod which seems to leave the bottom of the spark coil in Fig. 1. By raising and lowering this handle the ignition may be varied to take place at any point from the beginning to ¾ stroke, and with the gas full on, this will vary the speed from the fastest clip down to 3 or 4 miles an hour. The handle on the left side operates a valve in the gas pipe between the carburetter and the motor, and with this the speed may be varied to either extreme, or the motor entirely shut off.

The grip on the right-hand side of the handle bar operates a switch, by which the motor can be instantly shut off, by simply turning 1/16 of an inch.

To start the machine, first place the handles, gas and ignition in mid-position, then mount the same as the ordinary bicycle. Upon regaining the balance, turn the switch grip, the motor then takes hold, and feet may be allowed to come to rest at the position which best suits the rider. The speed may then be regulated by means of the gas and ignition-handle as best suits the operator.

This motor cycle is the result of considerable hard work, the experimenting covering a long period. First, the motor was hung over the front wheel and fastened to the fork sides, and was found to be very impracticable. The extra weight being placed so high, and as it had to be turned every time with the handle bar, it made the machine very hard to steer, especially going slow in a bad place, or among teams in a crowded street.

Next the motor was tried behind the rear wheel on a line with the hub, but it was found impossible to fasten it securely without adding almost as much tubing as was necessary in the main frame, which, besides the extra expense, makes the machine very ungainly in appearance. At this point a machine was examined that had the motor placed in the space occupied by the crank hanger of ordinary cycles, and without pedals. This machine, when once started, and when running between 10 and 30 miles an hour, worked to perfection, its only drawback being to get it started, even on the level, as you had to make a run with it and then mount, and at the same time be starting the motor. If the motor missed either of the first two or three explosions it would stop, and the operation would have to be repeated sometimes six or eight times before the machine could be gotten under way, it being almost impossible to start up hill. After having had the aforementioned experience, and having studied the matter thoroughly, it was seen conclusively that the only way to place the motor from any practical point of view was in the angle of the frame just over the crank hanger, in which it would have a solid foundation comparatively low down and high under the rider. The trouble was then to make the motor narrow enough to go in this space without sacrificing its wearing surface. The designer finally succeeded in making a motor that, taking the initial pressure of the explosion

to be as high as 600 pounds, has bearings of the same proportions as the best marine practice in steam engines, and to be of the aforementioned width. After having run this motor over 1,000 miles it was taken apart and carefully examined. Not the slightest sign of wear could be noticed, and it is believed that this motor will last from eight to ten years, with ordinary use and reasonable care. This machine will carry any rider of average weight from 3 to 30 miles an hour and up any ordinary hills, without the use of the feet.

NEW FORM OF ELECTRIC AUTOMOBILE.

This automobile was constructed by Mr. D. L. Davis, superintendent of the Salem Electric Light Company, of Salem, O., who has been engaged in work upon it for the past thirteen months. Its trial trip has been made, and we are told it proved most satisfactory in its workings. In the construction some new ideas have been carried out that are departures from those adopted by the American manufacturers of horseless vehicles. This new auto has a wheel base of 54 inches, and, owing to its different construction from other vehicles, its body is small and lower than customary, and the batteries of 40 cells are below the axle line, thus doing away with the clumsy and top-heavy appearance of many horseless vehicles. The wheels are of steel, with heavy rubber tires inflated. Two springs only are used, one on either side of the body and directly beneath the passengers. This feature proves a success, as the carriage is easy riding. In the application of power is where the auto differs radically from American machines generally. The power is supplied by two one-horse electric motors, which are connected with the front wheels, working independently of each other. The vehicle is also steered by the front wheels, which swing on pins close to the inside of the wheels, carrying the motors back and forth with them, the connection being made with brass contact plates which allow for the swing of the wheels. The frame work is of tubing, which is carried from the body up to the top of front axle, and through this tubing is carried the wiring from the batteries to the motors. The brake is stationary, the wheels being drawn up to the shoe when brake is applied. The reversing lever also applies the brake. The general appearance of the vehicle is handsome, owing to its compact construction. Its weight is about 1,400 pounds.

NEW FORM OF ELECTRIC AUTOMOBILE.

THE MOST POWERFUL LOCOMOTIVE EVER BUILT.

Judging from the accompanying illustration of the latest locomotive to hold the record for size, weight, and power, there is at present no evidence that we have reached the limit of possibilities in these gigantic engines. One would have thought that with a limitation of gage of 4 feet 8½ inches, and of height of 15 to 16 feet, the extreme size had been reached in such engines as were built by the Baldwin Company for the Lehigh Valley road, or by the Brooks Company for the Illinois Central Railroad. Yet a comparison of the principal dimensions of these two engines, and of the big locomotive constructed for the Union Railroad shortly afterwards, with the engine now under discussion, shows that the growth in size and power of the biggest freight locomotives still proceeds apace, as may be judged from the accompanying table.

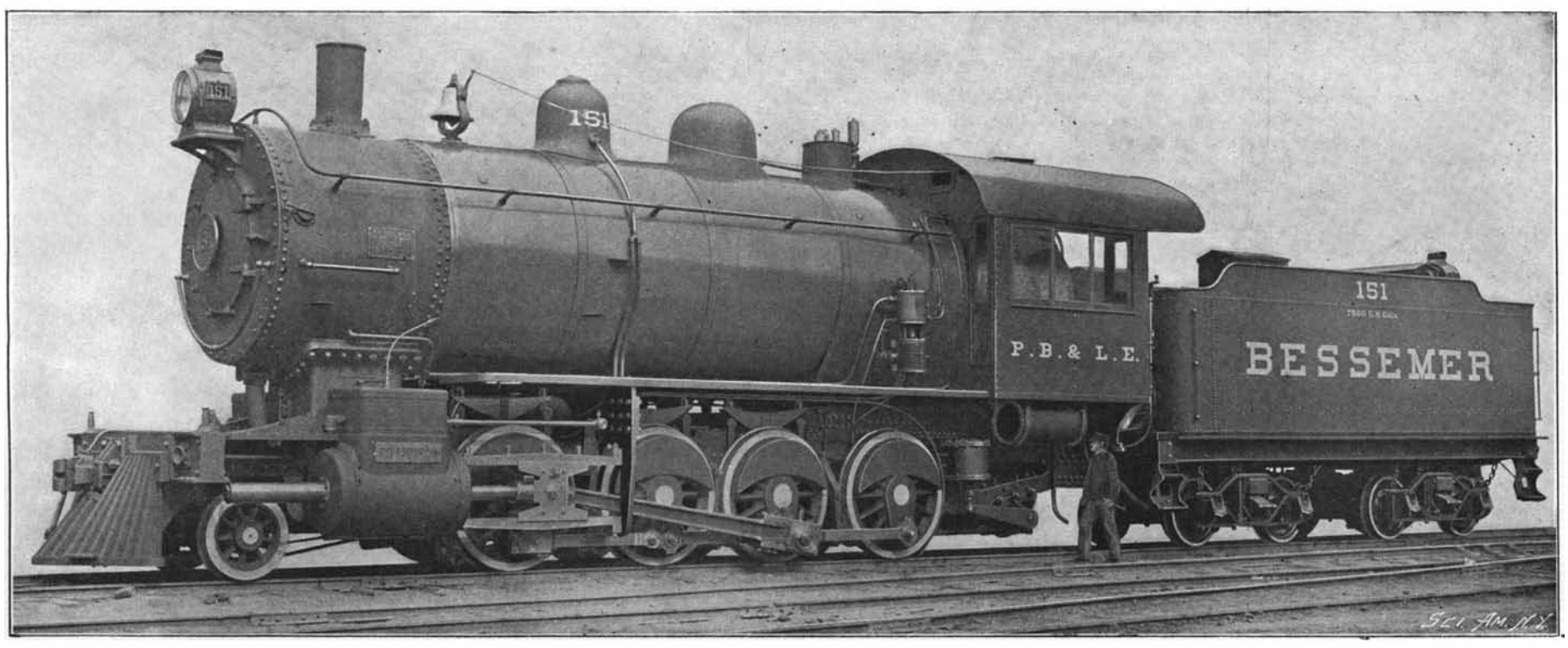
COMPARISON OF RECENT POWERFUL LOCOMOTIVES.

Railroad	P. B. & L. E.	Union Railroad	Illinois Central	Lehigh Valley
Builders	Pittsburg	Pittsburg	Brooks	Baldwin
Size of cylinders	24 x 32 in.	23 x 32 in.	23 x 30 in.	18 and 30 x 30 in.
Total weight	250,300 lb.	230,000 lb.	232,200 lb.	225,082 lb.
Weight on drivers	225,200 lb.	208,000 lb.	195,200 lb.	202,232 lb.
Total weight of engine and tender	391,400 lb.	334,000 lb.	364,900 lb.	346,000 lb.
Tractive power based on 25 per cent of adhesive weight	56,300 lb.	52,000 lb.	48,300 lb.	50,558 lb.
Net hauling capacity on level at 10 miles per hour	7,847 tons	7,261 tons	6,717 tons	7,049 tons
Ratio of tractive power to adhesive weight	4	4	4	4
Percentage of efficiency	100	92 5	85·6	89·8

Engine No. 150, which is herewith illustrated, was the first of the large engines of this class to be finished, and it is, by a considerable margin, the largest and most powerful locomotive yet built. These engines will be used in hauling exceptionally long, heavy trains of ore and iron at moderate speeds. The net hauling capacity on a level and nearly straight track is 7,847 tons, which is equal to the capacity and speed of a fairly large freight steamer of the present day. When the engine is working up to its full power, the drawbar pull is 56,300 pounds, or a little over two tons greater than that of the big Union Railroad locomotive which comes next to it in power.

The total weight of the engine alone is 125 tons, and of the tender 70 tons, the total weight of the engine and tender being thus only 5 tons short of 200, or fully equal to the weight of an average passenger train. The boiler is of exceptional size, measuring 88 inches in diameter at the throat-sheet. There are four hundred and six 2¼-inch tubes in the boiler, each measuring 15 feet over the sheets, and the total heating surface in the tubes is 3,564 square feet. The heating surface in the firebox is 241 square feet and the grate area 26·8 square feet. The total heating surface is 3,805 square feet. The driving journals, on the front intermediate, and back axles measure 9 by 13 inches, while the main driving journals measure no less than 10 by 13 inches; the main crank pin, moreover, is 7½ inches in diameter by 8 inches in length. The cylinders are 24 inches in diameter by 32 inches in length, and in themselves are as big as many a small stationary boiler; while the piston rods have a diameter of 4½ inches. The tender has a tank capacity of 7,500 gallons and carries 14 tons of coal. Big as this engine is, we suppose it will only be a matter of a few months before its dimensions are surpassed. Just in what direction the increase can take place it is difficult to say, as the width over the cylinders and the height of the smokestack must have about reached the limit of the loading gage. Any considerable increase in size must necessarily take place in a longitudinal direction.

BREAKAGE of propeller shafts at sea costs an immense sum annually in salvage. Mr. Justice Barnes, of the British Admiralty Court, said recently that during the past two years the amount awarded by that court for salvage of steamers thus crippled was £135,406, while the total awarded in other cases of salvage amounted to only £95,630.



THE LARGEST LOCOMOTIVE IN THE WORLD—RECENTLY BUILT FOR THE PITTSBURG, BESSEMER, AND LAKE ERIE RAILROAD.

Cylinders, 24 × 32 inches; drivers, 54 inches diameter; steam pressure, 220 pounds; diameter of boiler, 88 inches; total heating surface, 3,805 square feet; weight of engine, 125 tons; weight of tender, 70 tons; tractive power, 28 tons; net hauling capacity on the level at 10 miles per hour, 7,847 tons.

Correspondence.

Single-Rail Storage Battery Motor.

To the Editor of the SCIENTIFIC AMERICAN:

With reference to the instruction and description of the "Single-rail Storage-battery Motor" given in your issue of June 2, 1900, will you kindly allow me to state that for the rolling-stock shown and described therein, that is, with the wide tired road wheel on one side for balancing purposes, I hold Letters Patent No. 541,732, dated June 25, 1895, for the United States of America, and consequently the construction or use of such rolling-stock without my permission is, and would be, an infringement of my patent.

The difference between the two systems mentioned in the particulars furnished you by Mavor & Coulson, of Glasgow (who are, I have noted, the builders of the motor car shown in your illustration), as being employed in South America and India, respectively, is that while my patented system admits of trains, of trucks and passenger cars being worked by any kind of power, whether animal, steam, electricity, compressed air, or any other, the system used in South America requires every truck, whether it be full or empty, to be balanced by a man or animal of some description, and without such assistance no other power than animal, and that to every truck, can be utilized with it!

So far from either system being, as stated, "a form of the well-known Decauville system," that gentleman (Mr. Decauville) has had no more to do with its invention than Adam, as the system now in use in South America was invented and worked by me at Dibrugark, Upper Assam, India, so far back as 1881, and I abandoned it because of the impossibility of one or a pair of animals dealing with more than one truck, whether full or empty, at a time.

CHARLES EWING.

Adyar, Madras, India, July 11, 1900.

THE MANUFACTURE OF MECHANICAL RUBBER GOODS.

Less than two centuries ago rubber was known only to habitues of museums, and merely as a natural product having curious and interesting properties. To-day, seeing that it has worked something of a revolution in the industrial arts, and has so greatly promoted our manufacturing and commercial interests, it must be reckoned as an indispensable factor of our material progress. It has contributed so largely to many of the achievements of mechanical science that a world of interest naturally attaches to the different processes through which the crude rubber is passed, before it can be made available for engineering or mechanical uses.

Many and varied are the purely mechanical uses to which rubber is put. Contrary to a quite general but erroneous impression among persons unfamiliar with rubber manufacture, rubber is not melted but is moulded or pressed into a great number of different shapes, that are made flexible or inflexible according to the use for which they were designed. Belting and packing for machinery, all kinds of garden, fire, and suction hose, moulded and perforated door mats, tiling, etc., represent some of the common products in which rubber is the basis.

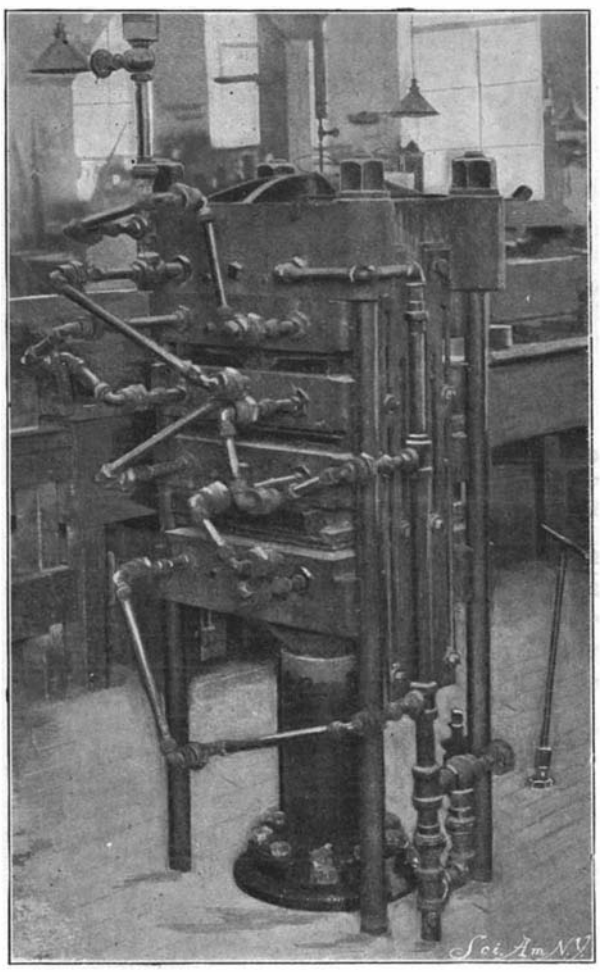
WASHING AND DRYING.—The first operation in the treatment of the crude rubber is the softening, which is accomplished by throwing it into hot water tanks, from which it is removed some hours later, cut up into small chunks, and thrown into the "washers," which are heavy machines having revolving corrugated steel rolls, which serve to crush and mangle the rubber passing between them, the sand and other impurities in the rubber being washed out by the small streams of water which play down upon it from a pipe above the washer, as indicated by the accompanying illustration of one of the washers. Sometimes the rubber contains a curious impurity in the shape of big brown rubber bugs, which have the interesting faculty of living for months in the recesses of the rubber "biscuit," without food and with little air.

The adhesive power of the raw rubber is such that a few minutes in the washers is sufficient to transform the rubber chunks into a continuous sheet of rubber, several feet long, and as wide as the washer rolls. These sheets, which are extremely rough, having somewhat the appearance of a Turkish towel, are allowed to dry, and are then crushed again between heavier steel rolls, the process being something like the kneading of bread dough. The power required to drive these machines depends upon the character of the rubber, varying from 20 to 40 horse power each.

THE MIXERS.—The grinders, mixers, or breakers, which are the names commonly given to the same type of machine in which the "compounding" is done, consist of two smooth hollow rolls, between which the rubber is thrown. The rolls are separated from one another by about half an inch, and, in turning, the rubber is drawn between them a little at a time until the whole mass is flattened out evenly, covering the roll nearest the operator like a blanket. From time to time the operator holds a knife against the roll, cutting through the rubber blanket as it turns; and as he cuts with one hand, making the incision run diagonally from side to side, he rolls up the severed portion with the other, until it becomes another good sized bundle, which he proceeds to throw again upon the rolls to be dragged through and crushed once more.

Under this kneading process, which at times, owing to the great cohesiveness of the raw rubber, requires a very large amount of power, the rubber becomes softer and is worked more easily. The rolls grow warm with the friction, in spite of the fact that cold water is sometimes kept flowing through them to reduce the temperature. When the proper amount of kneading has been done the operator begins the "compounding" process by sprinkling some of the material in his compound box into the rubber as the rolls turn. The black mass immediately assumes a streaky appearance, blending gradually, until the whole takes on a uniform grayish, reddish, or other tints, according to the use for which the compounded rubber product is intended.

As before stated, the rolls of these mixers are hollow, being provided with stuffing boxes on the ends, through which are passed water and steam pipes, so that the rolls may be heated or cooled to any desired temperature. Provision is made for relieving the rolls of condensed steam when heat is employed in the mixing process. The mixers, washers, and calenders are located directly over the shaft by which they are driven, and to which they are connected by gears arranged with friction clutches. It may be said that this is



SMALL HYDRAULIC VULCANIZING PRESS.

the general method of driving all the heavy machinery throughout rubber factories.

THE CALENDERS.—After the kneading and compounding, the rubber is taken to the calenders, and under the pressure of four polished steel rolls, one above the other, it is rolled out into long sheets of any desired thickness to be used for various purposes, among which may be mentioned the interior lining of rubber hose, the exterior cover of rubber belting, packing, etc.

The calenders are also used to turn out various kinds of rubber cloth, which is made by crushing the soft rubber into the cotton duck or other fabric that is passed through the rolls at the same time with it. As in the case of the mixers the calenders, which often require 50 horse power for their operation, are driven by heavy gears, provided with powerful friction clutches. The calender rolls are hollow and are provided with both steam and water connections.

VULCANIZATION.—This process, which was Charles Goodyear's great discovery, the greatest known to the rubber industry, may briefly be described as a method of effecting a chemical change in the rubber through the application of heat (usually derived from steam), taking away the stickiness of the rubber and giving durability and wearing qualities it would not otherwise possess.

Hydraulic presses of various styles and sizes are used for vulcanizing the moulded goods, belting, packing, treads, etc., the largest ones being used in the manufacture of belting and packing. For the vulcanization of the smaller moulded rubber goods small hydraulic presses having several platens are used, it thus being possible to vulcanize goods in several moulds at one time. Steam connections to each of the hollow platens are made in the manner indicated by the accompanying illustration by a type of movable, steam-tight, universal connection which permits the platens to be raised and lowered without shutting off the steam. One of the large presses, 25 feet long and 50 inches wide, weighing about 40 tons, is shown in the accompanying illustrations. The top and bottom plates are hollow and are heated by steam to a temperature that may be varied as desired. Thermometers are placed on the sides of these plates, so that the temperature may be kept constantly uniform. This is accomplished by means of inlet and outlet valves in the steam pipes. Under the lower plate are the hydraulic rams by which the plates are brought together, a pressure of 400 pounds being used to raise the plate, until it comes into contact with the goods, when the pressure is increased to 2,000 pounds per square inch and maintained there during the vulcanizing process. The pressure on the rams is maintained by high and low pressure pumps of 2,000 and 400 pounds pressure respectively. The pressure on the high pressure pump is kept at 2,000 pounds by means of patent regulators and also by an accumulator, which is a long cylinder standing on end, with a 6-inch ram in the top end of it, this ram being weighted so as to maintain a pressure of 2,000 pounds, and serving to secure a uniform pressure at all times throughout the entire system and preventing pounding in the pump itself.

On the left hand end of the press is located a hydraulic stretcher by which the stretch in the belts is taken out when they are being vulcanized. The stretcher consists of a set of very heavy clamps, to the end of which are connected two hydraulic rams, working under a pressure of 2,000 pounds per square inch.

In the manufacture of belting the cotton duck, which forms the main part of the belt, after having passed through the calenders and having rubber pressed through it, is rolled out on a table, say 125 feet long, and cut up into strips just the width of belt it is desired to make. The strips are then placed one over the other, as many ply as desired, and lastly a thin sheet of pure rubber is put on. The belt is then rolled up and is ready to go to the press to be vulcanized, the belt being finished after the latter process. Two of the largest rubber belts ever made are shown in one of the accompanying illustrations.

In the manufacture of hose a rubber tube is first slipped over an iron mandril, say 50 feet in length, and around this tube is wrapped a strip of duck, which is made wide enough to go around the mandril as many times as may be necessary to secure hose of the required number of plys. Outside of this duck there is then rolled a thin cover of pure rubber. The whole is then wrapped tightly with strips of cloth and put into a vulcanizer to be "cured." The vulcanizer for this work consists of a wrought iron tube, which can be closed at the ends, so that steam may be turned in until the desired temperature is reached. When the hose comes out of the vulcanizer it is slipped off from the iron mandril by means of compressed air, which is blown between the mandril and the hose until it is entirely loose, when it can be readily drawn off. It is then rolled up in coils ready for shipment.

In making the cotton-covered rubber-lined hose, which is used for fire department purposes, a somewhat different process is employed. A rubber tube is made by taking a long strip of pure rubber and turning it over to bring the edges together and cementing the seam. This tube is drawn through the hollow woven circular fabric; the ends are then slipped over hollow cones, to which they are clamped tightly. Steam is then admitted through the hollow cone, pressing the rubber tube into the cotton fabric, the heat of the steam vulcanizing it at the same time.

In the manufacture of suction hose, a large section of which is shown in one of the accompanying illustrations, round iron is coiled spirally in the machine shop, slipped over the mandril upon which the hose is to be made, and the spiral coil is then embodied in the hose itself, which is made up of woven fabric in combination with the rubber, somewhat in the manner indicated above in making the smaller hose.

Another interesting illustration is that showing a pile of rubber dredging sleeves, probably the largest ever manufactured, being 33 inches in diameter and seven feet in length. The sleeves are used for the purpose of forming flexible connections between the pontoons that support the piping through which dredged material is discharged.

The next issue of the SCIENTIFIC AMERICAN will contain an illustrated article, descriptive of the native methods of gathering and curing the crude rubber.

IT has been suggested that it would be well for legations in barbarous regions to have a wireless telegraphic apparatus, as communication could not then be interrupted by hostile forces.

Paris Exposition Notes.

The pavilion erected by the Swiss government occupies a central position in the Electrical Palace; it is of handsome construction and is arranged in several rooms, which give a considerable wall space; the main part of the exhibit consists in a series of large photographs and diagrams showing the principal Swiss hydraulic plants. These are shown by bromide enlargements of considerable size which permit the details of the dynamos and turbines to be clearly seen. In each case, a large water-color section shows the interior arrangement of the machines, conduits, gates, etc., and this is usually accompanied by diagrams of the electrical connections and circuits. Among the stations shown is the Kanderwerk plant on the lake of Thun, which has four alternators, together with the sub-stations in the city of Berne and the electric cars used on the traction system. The Rathausen station near Lucerne is shown, with the dynamos, transformers, and sub-stations. A number of photographs of the Jungfrau Railway show the line passing up the mountain, as well as the type of electric locomotives used.

The United States section in the Agricultural Palace contains a large and representative exhibit of American products; the façade of the section is designed in the style of the ancient Spanish missions of California. From the large central arch proceeds on each side a series of arcades, the roof being in red tiles. The interior contains exhibits of the leading American firms. Libby, McNeal & Libby have a large model of their packing house at Chicago, mounted on a platform about eight feet square. The windows are transparent, and the interior arrangements are shown, lighted by small incandescent lamps; the slaughter-house shows the cattle moving up an inclined plane, and a miniature train of stock cars moves back and forth. The engine house has three engines in motion, and the coal cars and coal elevator are shown, and the refrigerating cars, also in motion. Two electric motors underneath operate the moving parts. The same firm has a large case containing a model of the Ferris wheel in motion; the cars are replaced by glass platforms carrying canned goods, and the case contains an exhibit of lard, oils, canned and preserved meats, etc. Beside it Swift & Company have a large case containing hams, beef, lard, oils, bonemeal, etc.; and have also a fine model of a refrigerator car complete, about eight feet long, built in mahogany with glass sides. In the inside are represented carcasses, boxes of packed meats, etc. The exhibits of wheat and other cereals is especially noteworthy. The San Francisco Produce Exchange has two large cases with numerous samples of wheat, barley, and oats; the collective exhibit of the Oregon Railroad and the Portland Navigation Company shows different varieties of Club and Australian wheat and other samples, also photographs of wheat fields and implements. A number of other cases contain samples of wheat, oats, rye, and other grains from different parts of the Union. A number of cases in the rear have a collective exhibit of cereals of the United States, showing the new varieties produced by selection and hybridization. Near it is a case containing samples of maize flour, hominy, and grits of the Decatur Cereal Mills Company. Wheat flour in sacks is shown by the Alliance Milling Company, the Del Monte Mills, the Washburn & Crosby Company, and others. The corn exhibits are of interest; the collective exhibit of the Peoria Corn Exposition shows ears of red, yellow, and sweet corn in different varieties, and there is also a collective exhibit of corn from different parts of the country, occupying a number of large cases. Another part of the exhibit contains a large refrigerating case on the Chase cold blast system; it is of hexagonal form, and each of the six compartments contains a varied exhibit of cheese, butter in cans, lard, hams, sausages, etc. Near it the Armour Packing Company have two large cases showing canned meats, hams, lard, etc. The United States Department of Agriculture has a collection of maps, photographs, and statistics showing the number and distribution of dairy cows, creameries, and cheese factories in typical States and counties; the photographs show a number of dairy schools and other establishments. A large case contains the by-products of dairying, showing the economical use of casein, also albumen and similar products. Next to it are a number of cases containing different exhibits of condensed milk. Various collections of dairy utensils are to be seen; the Walker-Gordon laboratory is illustrated by apparatus and photographs. An interesting model is that of a creamery, which is placed on a platform about eight feet by ten. It shows a complete model creamery as operated in different parts of the country. The interior shows the different apparatus and appliances used, the ice house, etc. A number of tables contain dairy utensils, churns, cans, etc. A collection of milk testing instruments is shown, and an exhibit showing the component parts of cheese. The other parts of the section contain exhibits of fish, dried fruits, olive oil, wines, canned fruits, etc. The back part of the section contains a large collection of models of agricultural machines and implements, an extensive exhibit of tobacco, cotton, wool, grasses, fertilizers, etc. A three-story pavilion outside of the main building contains exhibits of agricultural machines and an American corn kitchen, where corn products are served to visitors.

Engineering Notes.

Strontianite or strontium carbonate can be purchased in Europe at $5 per ton for use in making fireworks.

In the waterworks at Coulouvrenier, near Geneva, a gigantic centrifugal pump has been installed. It lifts water 460 feet, and when running at full speed of 600 revolutions a minute absorbs 2,000 horse power. It is driven by two two-phase induction motors operated by electric currents from Chevres. The pump is arranged to give the necessary pressure to overcome the great head against which it works by a simple tandem arrangement of two centrifugal vanes. Injectors are provided to fill the casing with water, the pump being started up with closed valves. This gives the motors only the friction of the water in the wheel case to work against in starting. After they have attained full speed the valves are gradually opened. The pump delivers 5,000 gallons a minute.

A novel type of marine engine has been lately applied by Messrs. Hawthorne Leslie and Company to the Chilian training-boat "General Baguedano"; it is designed to give the maximum effect when the boat is propelled at full speed, with greater economy and power than is possible with the ordinary type of marine engine. It is built in a single unit, one-half of which can be used at a time. The engine is triple expansion, and has six cylinders acting each upon a crank of the main shaft. Two high-pressure cylinders, two intermediate and two low pressure are thus placed in line, the two like cylinders have their cranks at an angle of 180°, and the diameters thus formed divide the circumference into three equal parts, the cranks being found at 60° intervals around the shaft. The first high-pressure cylinder discharges into the first intermediate and first low-pressure cylinders, and the second set is arranged in the same manner; each of the low-pressure cylinders has a separate condenser. In this way two triple-expansion engines are obtained, and when it is desired to work at half the power it is only necessary to unbolt the crank heads of one set. This arrangement appears to work well in practice.

On the great Northern Railway of England the problem of automatic couplings has been ingeniously solved. As a foundation the automatic coupler of the Master Car Builders' Association of the United States has been taken, and this had been modified so that it is incorporated with the ordinary English hook and chain. When the coaches are to be coupled automatically, the couplings are so arranged as to be held rigidly in a horizontal position when they engage in the usual way common in the United States. If, however, the carriage is so fitted as to be incorporated with an ordinary train, the automatic coupler is allowed to hang vertically and the hook common to British carriages is exposed, and can be used with a shackle exactly in the usual manner. The side buffers are arranged so that they can be run back out of the way when not required, but if the hook and shackle are used they are brought forward and held extended by a half sleeve on the shanks; the usual play on the buffer springs being, of course, retained. Other English railways, namely, the Northeastern, the North-British and the Great Central, are also fitting their rolling stock with automatic couplers of the same description.

The work of dismantling an immense Corliss pumping engine is actively going on at Allentown, Pa. The pump, which was built in 1868, was constructed for the Lehigh Zinc Company, for the purpose of obtaining water from a mine. The cost of building and installing the engine was almost a million dollars. The difficulties of erection were rendered greater by the engine being placed near the mine shaft. The engine frame and bearings are bolted to solid cut-stone masonry 80 feet deep. Owing to the fact that the mining interest waned, it is decided to abandon the engine. It has not been operated for three years. At the time that its destruction was begun it was in excellent condition. Dynamite will be used to throw down the heavy walking-beams from their bearings, while blocks and tackle will prevent them from falling after the explosion. After that each one will be broken into suitable sizes for shipment. It is estimated that there are no less than 60 tons of brass alone in the bearings and fittings. The height of the engine from the surface of the foundation to the top of the walking-beam is at least 50 feet. The weight of the entire engine is estimated at 1,500 tons. The diameter of the steam cylinder was 110 feet and the stroke was 10 feet. The pump was intended to deliver 14,600 gallons of water per minute. There were two walking-beams mounted on the same shaft 10 feet apart. They were jointed at their heads by many rods 2 feet in diameter, to which the connecting rods were fastened. Each beam weighed 44 tons. The fly-wheels were two in number, one situated on each side of the steam cylinder, weighing 98 tons. Steam Engineering, from which we obtain our particulars, states that the fly-wheels were 30 feet in diameter.

Electrical Notes.

The public offices in Rangoon are to be provided with motors for punkah-pulling and also with electric lights.

London now has girl district messengers as well as boys. The girls range in age from sixteen to eighteen years and are said to be as efficient as the boys.

The Superintendent of the Pennsylvania Railroad has a telephone in his private car. Whenever he wishes to communicate with any place upon the line, the car is stopped and a lineman makes connection with the wires along the track.

Herr Stark considers that the disintegration of carbon filaments in incandescent lights and their deposit of carbon on the inner walls is due to vagrant currents between various parts of the carbon filaments which traverse the intervening gas as in a Crookes tube.

The new electric locomotive for the steepest portions of the Jungfrau Mountain Railway will be the most powerful electric rack-wheel locomotives ever constructed. The two motors will each have 125 horsepower, and will make 800 revolutions per minute driving the toothed wheels.

In the month of July occurred an interesting anniversary—the twentieth anniversary of the Edison incandescent lamp. It was in July, 1880, after twenty years of experimental work, that Edison gave the first public exhibition of his incandescent lamp in his laboratory at Menlo Park.

Sir Henry Irving is very fond of fine stage effects, and in "The Lyons Mail" he has introduced some remarkable electrical effects. Thus there is an electric light in the arm of a sofa, concealed from the audience, but illuminating a spot which could never have been reached in any other way.

Glass insulators through which the wire was run that carried the first message for the telegraph line from Baltimore to Washington were found a short time ago by a workman in the Document Room of the Senate. It was known that insulators were placed in the building by Prof. Morse, but their exact location was not known.

The first electrically equipped train on the Manhattan Elevated Railway, New York city, will probably run September 15. The engines and generators are being rapidly completed. A trial train is nearly finished and by next summer it is thought that the steam locomotives will be entirely dispensed with. The Second Avenue Railroad will be the first line to be equipped electrically. The total cost of making the change is said to be $12,000,000.

A new form of resistance for electric heating apparatus consists of a mixture of powdered nickel and white clay, 60 parts of the former and 40 parts of the latter, which is mixed with 6 per cent of water and compressed into the desired form under great pressure. Where the contact points occur the quantity of nickel powder is increased in order to diminish the resistance. The new material is said to be very solid and does not deteriorate under the action of heat.

Considerable interest is taken in the possibility of a high-efficiency incandescent lamp consuming 2½ Watts per candle or less. The General Electric Company has been able, with a special form of filament and by the use of a reflector that concentrates the light in one direction, to increase the practical efficiency of the incandescent lamp to less than 1½ Watts per candle per unit of light in useful direction. The lamp is of peculiar shape, being flattened. The filament is made in a four-coil spiral so as to give the maximum amount of light from the tip end of the lamp. The reflector lamps are backed with a special reflecting composition giving a highly polished mirror reflecting effect. The composition is durable and is not affected by the heat of the lamp.

In the construction of the Port of Bruges, all the machinery and apparatus is operated electrically, the power being furnished by a central station containing three Willans compound engines of 500 horse power, driving three dynamos at 500 volts. The electric distribution covers the whole extent of the future port, and thirty motors are used for the operation of the different machines, including four brick-making machines, circular and band saws, the machines of the boiler shop, those of the central repair shop, and the machines used in the construction, which include 3 large pumps, 5 mortar-mixers, a stone breaker, the windlass of the excavating conveyor, pile-drivers, 3 derrick cranes and 8 smaller cranes, besides numerous other machines. When the port is finished, current will be supplied for the motors of the rolling gates of the locks and for the revolving bridges. The four brick-making machines have a mean daily capacity of 160,000 and have reached 200,000; each is operated independently by a motor. The boiler shop carries on heavy work, such as the envelopes for great blocks of béton of 3,000 tons, for each of which 5,000 tons of plate and corner pieces are necessary. For the construction of the jetty, over 2,800 tons of steel will be used, in the form of uprights, timbers and cross-pieces; for the lock-gates, 700 tons of steel are used.

THE USE OF HARMONIC VIBRATIONS IN WEIGHING.

BY EDWARD MCGARVEY.

In the latter part of 1897 the writer began to experiment with certain vibratory devices in an endeavor to provide a pressure-indicator, which, when applied to weighing-scales, would afford a ready method of ascertaining the weight of an object placed on a scale, even though the beam or indicating part were removed to a distance, and a rapid and accurate means for automatically indicating and recording the weight of the cars in a moving train. The work which gave the best results was conducted along the following lines: A thin steel ribbon was suitably pivoted, the one end to a sustaining anchor-block, and the other to a scale lever or beam, in such a manner that the pressure of any object, whether it were influenced by gravity or other force, was, when acting on the lever, applied to the ribbon as tension. This ribbon was vibrated by means of the electric current. It will be readily seen that any change in the amount of pressure applied on the lever caused a corresponding difference in the fundamental rate of vibration of the ribbon, which difference varied in a certain ratio to the change in pressure.

While the method of the common pendulum and recording cylinder affords a ready and accurate means of measuring a rate of vibration when in the hands of a skilled person, it is, however, in connection with the present systems of weighing practically useless. Other means of determining from the change in the ribbon's rate of vibration the amount of force exerted upon it as tension had, therefore, to be provided. Two devices, both based upon the law of sympathetic vibration, but differing widely in details, have been developed by the writer, and accomplish the required result with a sufficient degree of accuracy.

In order better to understand the first of these methods the reader is referred to Fig. 1, in which the steel ribbon, *R*, pivoted on the supporting block, *H*, at one end, and similarly on the end of the scale-lever, *L*, at the other, is influenced by the electromagnet, *M*. At any distance from this arrangement of parts, another similar ribbon, *R'*, is placed in an inverted position, the upper end being pivoted on the scale beam, *L'*, at the point *O*. This ribbon is also influenced by an electromagnet, *M'*. At the pivot-bearings, *H* and *H'*, are placed spring and screw contacts, *C* and *C'*, which operate to open and close the respective circuits at each vibration of the ribbons.

Two distinct circuits are used. The one through battery *B*, through magnet *M'*, and line to switch, *S*, interrupter, *C*, magnet, *M*, and ground, is the main line circuit, and serves to vibrate the ribbon, *R*, and also the ribbon *R'* when it is in unison. The other, a short local circuit from battery, *B'*, through switch, *S'*, indicator, *I*, and interrupter, *C'*, serves to show by throwing a pointer on the indicator, *I*, when the ribbon, *R'*, is in a state of vibration. The pair of ribbons, being alike in every respect, have the same natural rate of vibration when subjected to the same degree of tension. By the arrangement of the circuit containing the electromagnet, *M* and *M'*, it will be observed that the impulses of current traversing it are controlled by the vibration of the ribbon, *R*. The other ribbon, *R'*, will, therefore, receive an active motion only when subjected to precisely the same degree of tension as the ribbon *R*; for then, and then only, can it vibrate in perfect unison with the impulses in the magnet, M'.

If the rod, *D*, be supposed to connect the lever, *L*, with the scale, on the platform of which rests an object to be weighed, the procedure will be as follows: The switches, *S* and *S'*, are closed. The ribbon, *R*, immediately vibrates, emitting a low musical note, and controlling the electromagnetic impulses in the magnets, *M* and *M'*, accordingly. The ribbon, *R*, however, is subjected to the greater tension, on account of the object on the scale platform; therefore, the ribbon, *R'*, fails to respond to the impulses of the magnet, *M'*, and remains at rest.

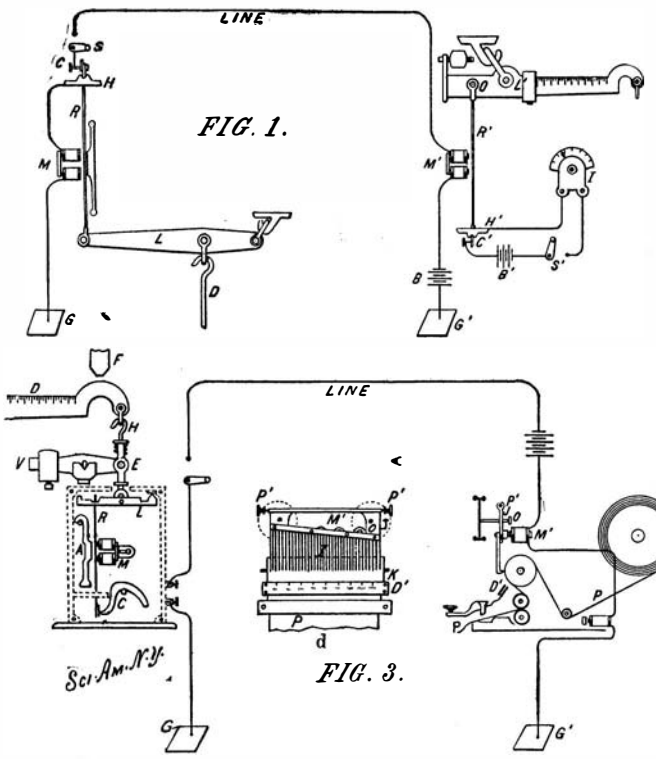


Diagram of a System of Weighing by the Use of Harmonic Vibration.

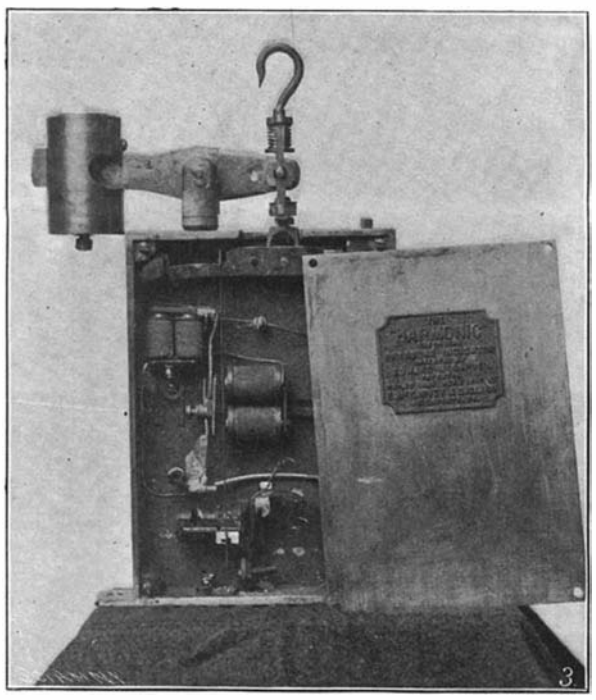
The poise on the beam, *L'*, is now moved by hand until the pointer on the dial of the indicator, *I*, falls back to the normal position, whereupon the correct weight will be indicated by the position of the poise on the beam, *L'*. The reader will understand that, as the poise was moved outward, the tension of the ribbon, *R'*, was gradually increased until both ribbons were in perfect unison, at which time the ribbon, *R'*, responded, thereby introducing resistance into the indicator circuit at the point of contact, *C'*. This fact was made known by the movement of the pointer on the dial of the current-meter, *I*.

The interrupter which first took the form of the common post and screw contact was replaced in both ribbons, by weighted hanging contact levers, the platinium tips of which rest against the springs on the ribbon-hangers. These interrupt the circuit by an inability to follow the rapid movement of the ribbons, and present the advantage of being always in adjustment, whatever be the position or vibratory rate of the ribbons.

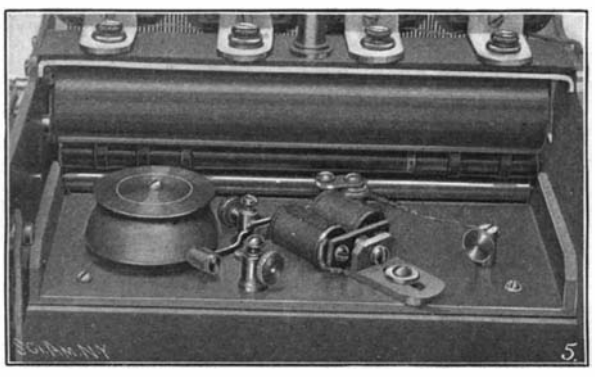
The second form of apparatus differs from the first in dispensing with the second ribbon. In its stead a series of thin reeds supported on the bar, *d*, Fig. 3, each having a different vibratory rate from the others by being slightly different in length or weight. The supporting bar is so arranged that it will be vibrated in unison with the ribbon at the scale, and the reeds are tuned in unison with the ribbon at the different degrees of tension corresponding with the force applied. Thus, when an object is placed on the scale and the circuits closed, only the reed or reeds having a rate nearest to the fundamental rate of the ribbon at that time will be vibrated. These principles form the basis of the recording indicator designed for use on the railroad track scale.

In Fig. 3 the principal working parts and circuits are shown, the metal case to the left containing the ribbon, *R*, magnet, *M*, lever, *L*, and interrupter, *C*. These parts communicate by means of the rod, *E*, and hook, *H*, with the clevis on the end of the scale beam, *D*, in such a manner that any upward pull exerted by a force acting on the beam will result in a corresponding increase in the fundamental rate of the ribbon, *R*. The extra lever, *V*, with the poise, serves to hold the ribbon and lever, *L*, in position, and also to give the proper adjustment of initial tension to the ribbon. The pendulum-like part, *A*, acts to start the vibration of the ribbon immediately when the current is switched on. Should the ribbon fail immediately to start, the steady attraction of the magnet, *M*, causes this part to strike a quick blow on the ribbon near the lower node. The vibration being started, the attraction of the magnet, *M*, becomes intermittent, whereupon the part, *A*, falls to its former position. A safety spring with proper adjusting screw is attached to the hook, *H*, which, in case the parts are overloaded, limits the tension on the ribbon by allowing the beam to rest on the post, *F*.

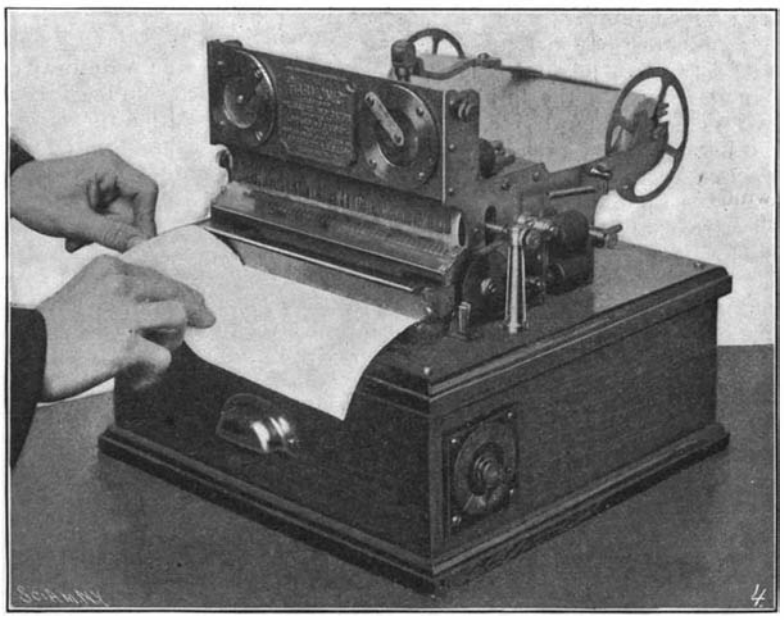
In the same figure to the right are sketches showing the main features of the recording mechanism, which are also shown in the other figures. The first sketch, a front view, *d*, shows a row of reeds, *I*, fixed to the plate, *J*. This plate, which is pivoted on the frame of the machine by trunnion-screws at *P P'*, and connected by screws at *O O* to the respective centers of two sheet-steel diaphragms, is vibrated by the electromagnets, *M*, in unison with the ribbon. Back of the reeds is placed the cylinder, *K*, over which the band of record-paper is drawn by feed-rollers operated by electromagnets. The tips of the reeds are slightly separated from the record-paper and engage with it only when actively vibrating. The reeds gradually decrease in length and increase in rate of vibration to the right. The reeds are tuned, the first one to the rate of the ribbon at its initial tension, and each succeeding one to the successive increments in rate due to a certain definite additional weight placed on the platform of the scale. As the reeds vibrate with full amplitude only when in unison with the impulses transmitted through the plate, *J*, and controlled by the ribbon, it



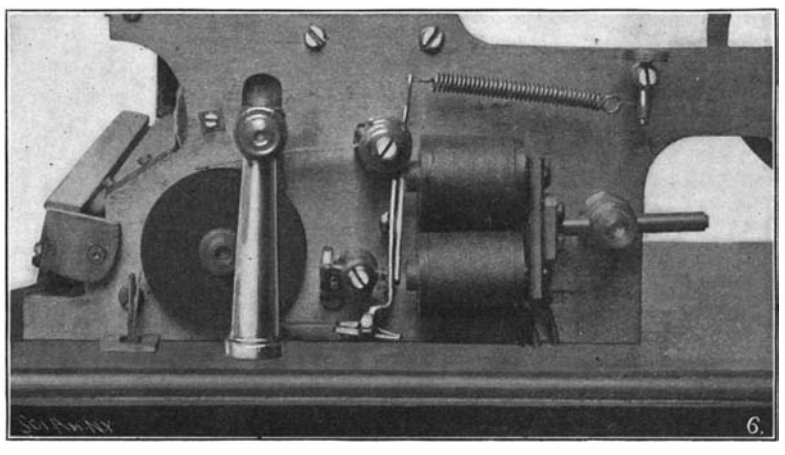
Case containing ribbon and parts.



The Back of the Recorder, with parts removed to show the Relay.



The Recorder.—Showing the manner of detaching a section of paper.



A Portion of the Driving Mechanism.

AN APPARATUS FOR WEIGHING MOVING RAILWAY CARS.

will be seen that any proper increase in the load will have the effect of throwing into motion a reed which is shorter and consequently nearer to the right of the bar. So well does this operate in practice, that by lifting on the beam with the hand, thus rapidly increasing the tension of the ribbon, the effect on the row of reeds of a wave moving from left to right is presented to the eye, so nearly instantaneously does one reed drop and the succeeding one take up the active motion. A rule, *D'*, graduated like the beam, *D*, on the scale is fixed in front of the cylinder and just below the tips of the reeds. The length of graduation is equal to the length of the row of reeds and the width of the band of paper. It serves to show in numbers the weight on the scale platform. The tips of each reed are opposite a division line.

The cylinder, *K*, which is properly insulated from the frame of the machine, is connected with a secondary terminal of an induction coil, while the frame is connected with the other terminal of the same coil.

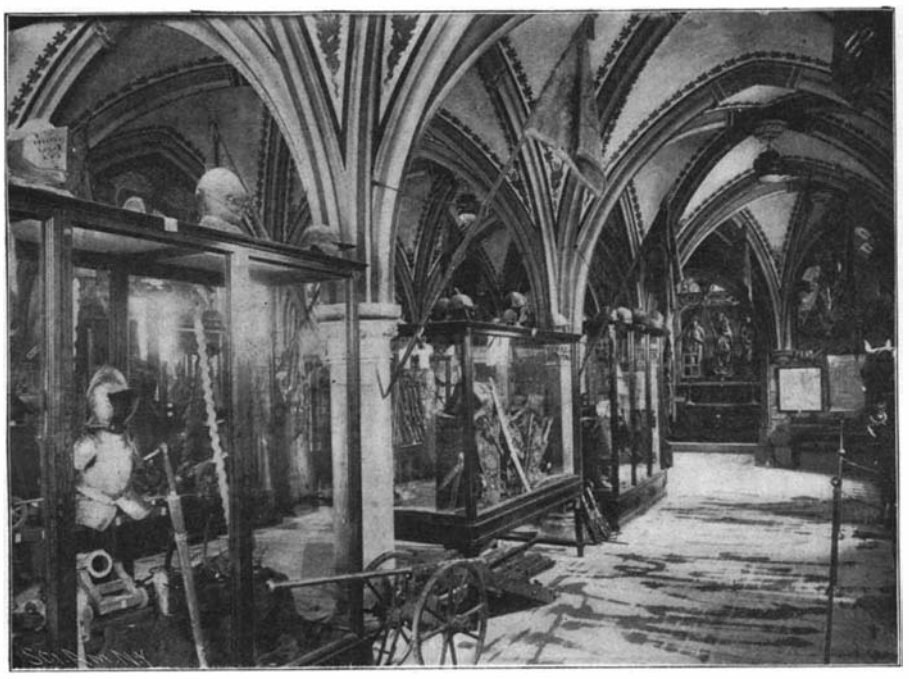
A spark gap adjustable by a screw leads the current until one of the reeds begins actively to vibrate adjacent to the cylinder, whereupon the spark following the path of the least resistance perforates the paper opposite the tip of the vibrating reed. During this time the ratchet motion has been operating to feed the paper forward. Hence, a line of perforations is burned in the paper band, the position of which line relatively to the edge of the paper indicates the weight of the car.

In the completed machine, as shown in photographs, the ratchet movement consists of two electromagnets, each of which drives an oscillating finger against a ratchet-wheel. Either of the magnets develops sufficient power to feed the paper independently of the other.

The dry cells, which operate the feed and the spark coil, are inclosed in a special box, on the front of which is arranged a series of contacts with arms for the convenient addition of new cells as required. The paper band which unwinds from a drum at the back of the machine during its perforation is fed out in front, and underneath a special rule, designed to be pressed down by a key, thereby enabling the operator readily to detach a section of the paper. Rail contacts are provided, by which the car will, when on the scale, automatically close the circuit and make the record. In the same circuit is placed a switch and key to be used by the operator. In order that the closing of a single circuit shall start all of the different movements, a special relay operated from the rail-contacts and key is placed in the base of the machine.

The arrangement of circuits in the apparatus is such that the recording mechanism may be removed to a distance to the scale, and placed for instance in a railroad company's general office, the regular telegraph line being used to conduct the impulses. The recorder will interfere in no way with the regular business of the line, nor will the operation of the regular instruments affect the accuracy of the weight records.

When a car weighing, for example, 96,000 pounds is on the scale and the contacts are closed either automatically or by hand, the ribbon immediately starts to vibrate at a rate governed by the weight of the car, thereby introducing impulses into the main-line circuit leading to the nearby or distant recorder; these impulses of current causes the plate supporting the reeds to vibrate and to transmit the motion to the row of reeds. Now, the only reed having the proper fundamental rate and, therefore, the only one to vibrate with full amplitude, is, if properly tuned, the one opposite the mark denoting 96,000 pounds on the graduated rule. As the feed motion and spark-coil were started by relay almost on the instant with the ribbon, the parts, as long as the circuit remains closed, continue to draw a line of perforations at a position on the band of paper denoting 96,000 pounds by the rule.



THE EXHIBIT OF ARMS IN THE HUNGARIAN PAVILION.

While, for the sake of clearness, mention was made of but a single reed vibrating actively, it is obvious that when the ribbon has a rate at a certain point between that of the two consecutive reeds having the nearest to the proper rate, both reeds will be vibrated with equal amplitude and make a record; and in no way will the accuracy of the record be thereby impaired, as two but slightly separated lines will be drawn, which can be correctly averaged on the rule with the eye. When this system of weighing was recently tested on an 80-ton scale owned by the Central Railroad of Pennsylvania, under the supervision of Superintendent of Motive Power, J. J. Walsh, highly satisfactory results were obtained, and the practicability and merits of the system were fully demonstrated. The tests were made with moving cars, and it was shown that less than one second of time elapses after the circuit is closed, until the ribbon and reed respond to the proper rate. From this and other practical tests, it is not too much to say that the feat of weighing a train moving even at regular transit speed over any properly constructed scales, and of simultaneously recording the weight of the successive cars, is within the capabilities of this system.

THE PAVILION OF HUNGARY—STREET OF NATIONS AT THE PARIS EXPOSITION.

PALACE OF HUNGARY AT THE EXPOSITION.

One of the most interesting of the National Buildings overlooking the Seine is that of Hungary, designed by the architects, Balint and Jambor. Its different façades represent portions of celebrated buildings; the side facing the Seine, shown in the illustration, shows the Tower of Kormocz and part of the Château de Vadja. The tower, which rises to a considerable height, spans the pavement by pointed arches, with a smaller arch in front. The middle portion has three tourelles, forming bays, which, with their connecting portions with gothic windows, give a picturesque effect. A small gothic chapel terminates this portion of the building. The sides, in the Renaissance style, are of a golden yellow, contrasting with the gray of the main façade. In the rear of the building, shown in the illustration, the portal is copied from the ancient Chapel of Gyulafehervar; a smaller Renaissance façade is seen on the left, and on the right is a massive octagonal tower, with pointed roof. The building is entered from a handsome portal; the different portions are built around a central court; the three low galleries opening into it give the effect of a cloister, with arched windows and straight or twisted columns. On one side an exterior staircase leads to the upper story. The gallery nearest the entrance is finished in polychrome decoration, in which reds and yellows predominate. At each end is an arched doorway, surrounded by reliefs and paintings. Here are reproductions of the tombs of George Apaffy XVII. and of Queen Isabella XVI. The rooms on the lower floor contain different collections of ancient arms and armor. In the first room are cases of rude looking Hunnish weapons of iron, swords, battle axes and arrow heads; the second room contains a reproduction of a sarcophagus in bronze relief from the Cathedral of Zara, and a number of ancient manuscripts and documents, besides a richly decorated saddle, battle axes and swords, the latter of the twelfth century. The illustration shows the main hall, which corresponds to the portion next the Seine; it has the form of a crypt, terminated by the chapel, with rich stained glass windows; the main portion is decorated with polychrome designs and by frescoes representing battle scenes, flags, suits of armor and cases of ancient arms.

In the central case is the saddle of Prince Bethlen, seventeenth century, richly embroidered in red and cloth of gold, and a number of ornamented sabers, one of which, seen in front, has a gold scabbard in relief designs. Saddles, guns with carved or inlaid ivory, armor casques, etc., are seen; among the latter is the pointed casque of Nicolas Zrinyi, sixteenth century, and the battle-hat of the Archbishop Fomory de Kalocsa, of leather with steel bands; also the saber of Mathias Corvin, king in the fifteenth century. Another illustration shows a collection of ancient fishing and shepherds"

implements in one of the rooms; in the center is a canoe hollowed out of a log, from Lake Balaton, with nets and harpoons. The various panels contain shepherds' crooks, pouches, utensils, objects in carved horn, and whips with inlaid handles, axes, etc. Harpoons and nets are seen in the rear, the prehistoric collection shows primitive harpoons, fish baskets, and curious bone skates. On the upper floor is a large hall, facing the Seine; it is richly decorated, the roof beams and spaces are in gold and colors, with coats of arms and battle scenes. Above the doors of carved wood is a large battle scene covering the side of the hall, representing the charge of hussars; at one end are two stained glass windows, and at the other a large arch looks down into the chapel. The remaining rooms are devoted to collections of bronzes, manuscripts, and various objects.

Some Mysteries of Our Common Fishes.

BY CHARLES MINOR BLACKFORD, JR., M.D.

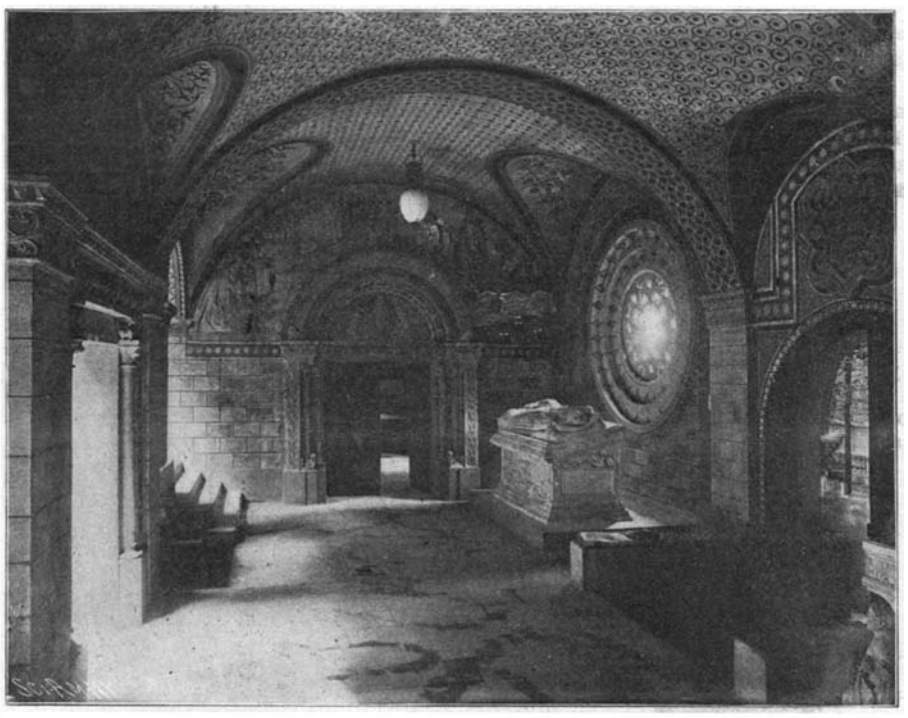
Fishing, for sport or profit, is practiced throughout the world wherever suitable waters are found. Seas, lakes and streams aid in furnishing food to the dwellers on their shores. At the present time few industries rival the fisheries in importance, either in the amount of capital invested or the value of the product; yet it is only within the last few decades that human knowledge and skill have been applied to aiding nature in maintaining the supply of fishes. When we consider the thought that has been given to increasing the yield of grain or number of cattle, it seems remarkable that such should have been the case; for fish enters as generally into the food of human beings as any vegetable or meat item. Were our wheat crops dependent on natural methods of sowing, the world would fare badly for bread; and the fate of the American bison shows what would happen were nature our only herdsman. It was the rapid decline of the fisheries throughout the world, which drew the attention of scientific men to the preservation of our fishes, with the result that the extermination of certain species has already been checked and that many fisheries are more productive than at any time in the past.

In many respects our knowledge of even the commoner fishes is incomplete. Some of them would be of value to commercial fishermen if they were fully known. One of these subjects for investigation is the habits of the migratory fishes, such as the herring. It has been long known that certain fishes migrate in great schools, but aside from the knowledge that they go in quest of food or of a place to spawn, little has been discovered in regard to the laws governing this migration. The fishermen have a number of rules that at times are more or less true, but their lore is so mixed with superstitions or based on such faulty observations as to be of little real value. The fishing fleets often lose much time in searching for the schools, and fares could be obtained much more quickly and surely were the movements more thoroughly understood. Sometimes the fish leave a certain shore for several years and the industry seems to have perished; but they return as unaccountably as they departed and in equal or greater numbers. Such occurrences make it difficult to collect data in regard to fisheries, because an apparent decline or increase may be due to unknown causes that do not enter into our calculations and so vitiate our reasonings. It is, therefore, almost impossible to determine the effect of changes in fishing methods or implements or any other steps that may be taken, because the changes that may follow are not necessarily produced by the innovation.

One of the most familiar of the herring family is the shad, the alosa sapidissima; and yet very little is known of its life history. This fish presents the curious anomaly of a salt water fish that is known only in fresh water, for it is taken when it comes into the rivers to spawn and after this duty is performed, the whole body returns to the sea, leaving but a few stragglers behind. To what part of the ocean they go, on what food they subsist, and at what depth they live are all unknown. About the middle of November the "run" begins in the St. Johns River in Florida, and as the season advances the fish appear with a fair degree of regularity on the successive rivers toward the north. The large catches of the spawning fish, made by means of the dams that barred their access to the upper reaches of the streams and the destruction of the spawning beds by sawdust and other refuse, which, owing to the lack of prohibitive laws and to the short-sighted policy which delayed proper legislation, was thrown into the water courses, so depleted their numbers that the first care of the United States Fish Commission was the restoration of this magnificent food fish. To the intelligent, skillful work of this Commission is due the abundance of this important animal.

Not content with restoring the shad to its native waters, the United States Commission transported it across the Continent and planted its eggs in the Pacific, where shad had been unknown. The experiment proved a brilliant success, and the shad now abounds along the coast from Mexico to Alaska. The habits of the fish have undergone a change, however, for its migratory instinct is not so marked, and instead of appearing only at a definite season it may be taken at any time of the year. There is a tradition on the Atlantic coast that a shad returns to the river in which it was hatched, but if it be true in Atlantic waters, it is not so in the Pacific. The fry were chiefly planted in the Sacramento, from which river the fish have spread along the whole coast, which would be the case if the tradition were well founded.

The salmonidæ are better understood than most fish families, yet much remains to be discovered about them. The Pacific salmon is distinguished by a well-established trait, which is certainly interesting. The adults spawn only once in a lifetime. They reach the spawning ground in good condition, but after depositing the spawn their tissues soften and degenerate, allowing the fish to be attacked by "fungus" and bacteria, so that they all die. The whole adult generation is removed, and the chances of life for the fry are correspondingly increased, as food is more abundant and cannibalism is impossible. This trait may have some bearing on the much-mooted close season problem, as nature seems to preserve the race by removing all the adults in the interests of the young, and to indicate that it is more important to protect fry than to save the full-grown fish.



INTERIOR OF ONE OF THE HALLS, SHOWING TOMBS.

When artificial culture was begun, great were the expectations aroused, and these have been fulfilled only with those fish whose biological history is best known. Great numbers of eggs are hatched, but the production of fry is not the sole aim of piscaculture. Fish, not fry, are wanted, and the success in rearing full-grown fish is dependent on the knowledge of their biological history. The experience obtained with the whitefish shows this to be an unquestionable truth.

The whitefish (Coregonus clupei formis) is abundantly found in the Great Lakes. It constitutes the most important fresh water fish on this continent, and perhaps in the world. In 1897 the catch of this fish alone aggregated 7,048,443 pounds, valued at $250,722. To maintain this fishery the United States Fish Commission and the commissions of the several States interested have established hatcheries for whitefish. During the year ending June 30, 1898, the United States Fish Commision stations hatched 81,688,000 fry, and it is safe to estimate that the various State hatcheries did about the same. Assuming this to be the case, there would be a total of about 163,000,000 fry for a single year.

The addition of this enormous number of young fish annually should materially increase the catch, but it is not evident that it has done so. The whitefish has not been exhaustively studied, and many gaps exist in the knowledge of its life cycle. Neither its spawning habits nor its spawning beds are well known. It is known to be a rapid swimmer, and able to cover many miles a day. The females are able to retain the spawn for a while after they are "ripe," so that the capture of fish from which spawn may be taken does not necessarily point to a given locality as the spawning ground. The fish may be en route, and until the natural environment of the young fish is known the fry cannot be planted to best advantage.

The food of fishes is a field in which further research is needed. Dr. Ryder and others have done valuable work in this direction, but much remains to be done. Before a stream or lake can be successfully stocked with a given fish, the food for that particular fish must exist in sufficient quantity, and it would save time, trouble and expense if this could be determined in advance. It is often difficult to ascertain the nature of the food, and to do so the stomachs of many specimens must be examined and the real food separated from extraneous and accidental ingesta. If one watches a sheepshead feeding, it is hard to believe that it is not a vegetarian. The fish browses among the branches of algæ as though nibbling them, yet a close inspection shows that it is devouring the multitudes of small crustacea and other tiny animals that crowd about the sea-weeds. In pursuit of this prey, the fish sometimes nips off bits of the weed and swallows them, but these particles are accidental and should not be considered food. It is probable that lack of attention to this element in food supply may account for some of the failures of fish culture.

In these unexplored fields of science there is much that will repay patient research; for every addition to the store of our biological knowledge is a valuable aid to the men who have made the preservation of our fish their life work.

Power Plant of Metropolitan Electric Supply Company.

As the original central station of the Metropolitan Electric Supply Company, of London, was found to be insufficient and could not be enlarged, the company decided to erect a new station at Willesden. This station includes two boiler houses, each 350 feet long, and between them is the dynamo room, of the same length and 112 feet wide. When completed, the station will furnish 45,000 horse power. At present but one-fourth of the total plant is installed; of the boiler room, a portion 150 feet long has been built, containing sixteen Babcock & Wilcox boilers, provided with superheaters. The dynamo room, terminated by a temporary wall, measures 162 by 68 feet; it contains three generating groups, consisting of an engine and a Westinghouse alternate current dynamo. The engines have a capacity of 2,500 horse power, giving 116 to 145 revolutions per minute; they are of the vertical compound type, with cylinders of 36½ and 56 inches diameter and 36-inch stroke. The dynamos give two-phase current, and are direct coupled to the engines; their capacity is 1,500 kilowatts, at 500 volts and 60 cycles. The dynamos have 62 fixed poles and movable armature; the exciters are mounted on the main shaft, and are compound-wound. The tension is raised at the station from 500 to 10,000 volts by twelve transformers of 250 kilowatts each. The energy is conveyed to three sub-stations which contain in all thirty transformers of 100 kilowatts; for the transmission, five cables leave the central station; the distance from the latter to the farthest sub-station is about ten miles.

An Automobile Exhibition at Trenton.

An automobile exhibition will be held at the Greater Inter-State Fair at Trenton, N. J., September 24 to 28. An opportunity will be afforded to all manufacturers to show their vehicles, and a special building has been erected for automobile interests. Nearly every manufacturer will be represented, and 30,000 square feet will be needed.

Trenton is well located between New York and Philadelphia, and it seems as though the idea of having an Eastern automobile exposition and race-meet at this point could be successfully carried out. A club run from New York to Trenton two days previous to the opening of the Fair is being organized. A run will also be made from Philadelphia to Trenton. They will be under the direction of the Automobile Club of America and the Automobile Club of Philadelphia. Various races and contests will be held upon the track.

It has frequently been assumed that the collection of dust on electric light wires and fittings was due air currents due to thermal causes. Mr. A. A. C. Swinton's experience has convinced him that electrostatic attraction is the cause, particularly where the supply is at 200 volts from the street mains. He says it is when the switch is off, in the case where it is in the negative conductor, that the accumulation of dust takes place. Having regard to the comparative lowness of the 200 volts potential, from an electrostatic point of view, the rate at which the dust accumulates on the cords is most surprising.

WHITE INDIANS OF NEW MEXICO.

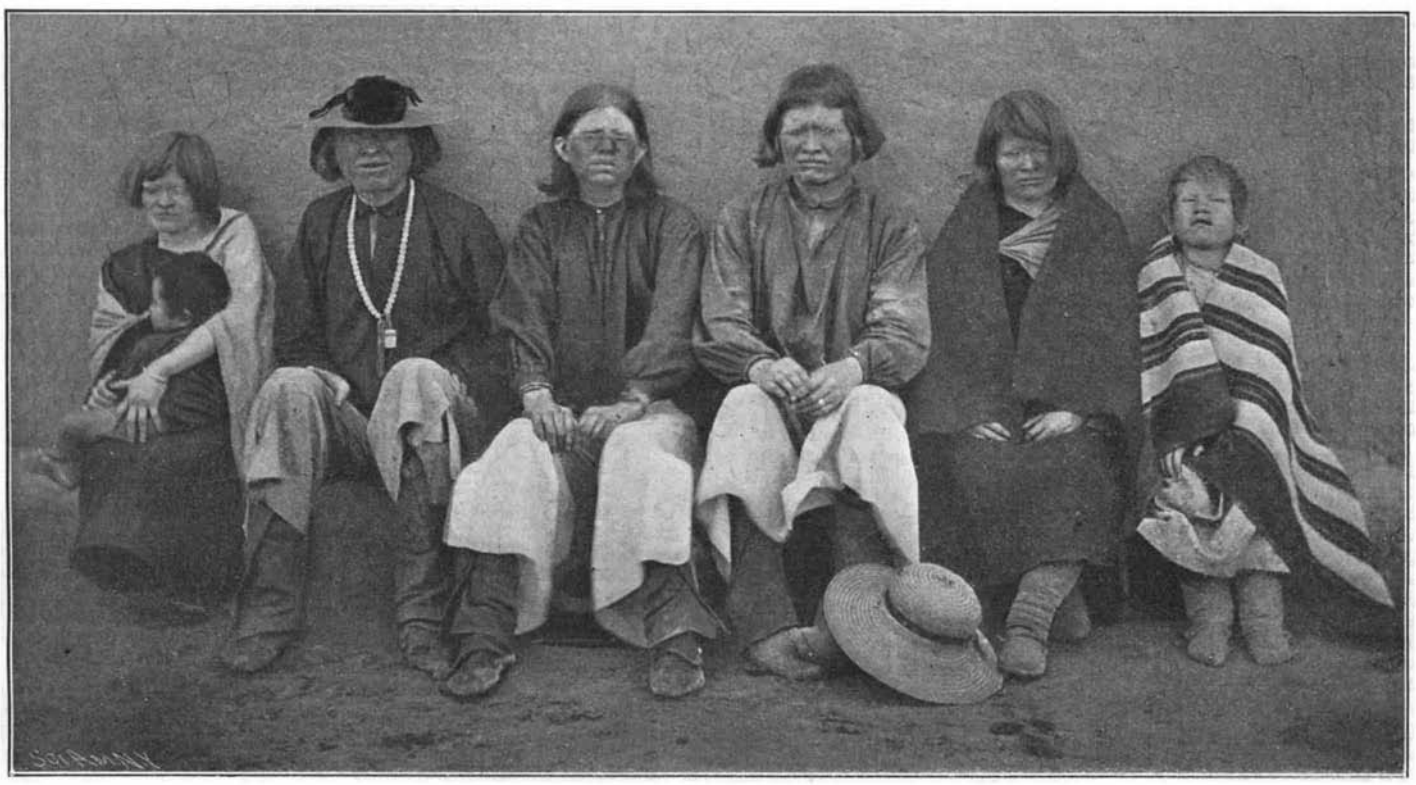
BY COSMOS MINDELEFF.

For more than a hundred years the question whether there existed in America a tribe of white Indians has been agitated, and more or less positive statements from learned men can be quoted on both sides. That the legend of a white race had a basis in fact is proved by the photograph which is published herewith, and which shows, not a tribe, but six individuals, living in the Pueblo of Zuñi, New Nexico. Their existence, however, is known to very few, and even of those who have visited the village not many have seen the white Indians, for as a rule they keep themselves out of sight. The history of the legend is interesting.

From the earliest times more or less definite rumors about white Indians have been current. In 1791 the Reverend Doctor John Williams published a treatise on the subject, which is now very rare, although the impetus which he gave the inquiry still survives. The purpose of the publication was to start a subscription fund, to be devoted to the exploration "of the wild parts of America beyond the Ohio River," where the author was sure the long-sought white men would be found. In his own mind there was not the slightest doubt that these whites were descendants of Prince Madoc of Wales, who, according to the old Welsh legend, left his native country soon after 1170 A. D., on account of family dissensions, and sailed out to the West, leaving Ireland on his right hand.

According to the ancient bards, Prince Madoc returned in the course of time with glowing accounts of a new country he had discovered, and gathering his adherents about him he set sail again for the far West, to the land which he had found, and was never afterward heard of. Dr. Williams contended that the white Indians were the descendants of these twelfth century Welshmen, and whatever may be thought of his conclusion his argument was certainly worth consideration. He cited the many reports concerning these Indians then current, coming from various parts of the American continent, particularly the account of a man named Rimington, a native of England, who had met the white Indians at a grand trading meeting, or Indian fair, at the forks of the Ohio. He was told that they came from a remote district, west of the Mississippi. Rimington's companion, a Welshman, claims to have spoken to these Indians in his own language. It was said also that these Indians had a book, which they venerated highly, but were unable to read.

More than sixty years later, when the Pacific Railroad surveys across the continent were made, the story cropped out in another form, but the white Indians were definitely located at the Pueblo of Zuñi. In the reports of that survey, published in 1856, a description of one of these Indians is given, together with a list of words, which were said to be practically synonymous in the Zuñi and Welsh languages. No explanation of the presence of white members of the tribe was attempted. About 1877 J. H. Beadle, a newspaper correspondent, visited Zuñi. He mentions a book which those Indians had, and which they regarded with great reverence, although they could not read it.



WHITE INDIANS OF ZUNI, NEW MEXICO.

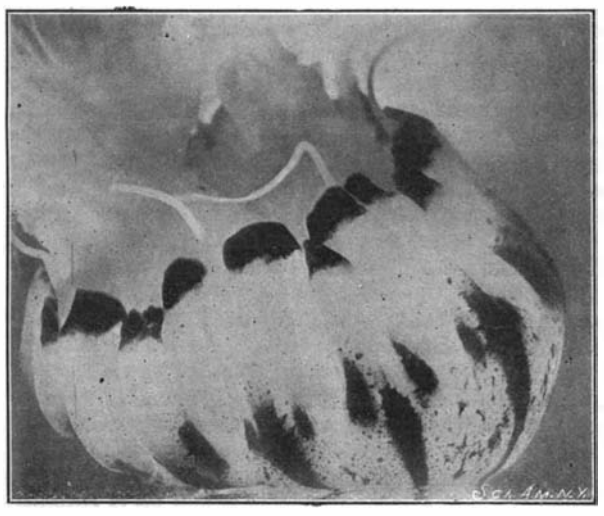
There can be no doubt that the white Indians at Zuñi are albinos. There are four others at the Moki villages and several scattered among the other Pueblos. In dress, manners, customs, language, they are like their fellows, but their complexion is very fair; they are, indeed, much whiter than the average white man who has lived much in the open air. Their hair is a tawny yellow, instead of the jet black which characterizes the Indian. Their eyes are so weak that they have to keep them closed in the sunlight, as shown in the photograph. This is due, doubtless, to the absence of coloring matter in the iris. As the skin lacks that protection also, these people suffer very much from sunburn, where the regular Indian is almost as immune as a negro. Their eyelids and lips are always sore, and it is probably on account of their dread of the sunlight that so few travelers have seen them.

To those who have seen these curious freaks they give the impression at first that they are Irishmen dressed as Indians, for their faces have a decidedly Celtic cast. The only way, however, in which they differ from other members of the tribe is in the absence of coloring matter in the skin and hair. The cause of this albinoism has not been determined; it may be due to close intermarriage within the family, an inevitable result of the social system of the Pueblos, and their organization under the clan or gens system.

SOME PACIFIC JELLYFISHES.

BY CHARLES F. HOLDER.

In making the trip from San Pedro to Avalon, or from San Pedro to San Diego, into the warm waters of the great black current of Japan, the traveler is



PHOTOGRAPH OF A JELLYFISH, TAKEN AS IT REACHED THE SURFACE.

charmed with the display of large jellyfishes, particularly abundant in March and April.

The form most conspicuous, both for its size and beauty, is the one shown in the accompanying illustration, which was photographed as it had just reached the surface. The jellyfish was eight or ten feet in length, consequently the opalesque disk alone is seen, splashed with markings of a deep lavender. The picture has a peculiar interest inasmuch as it is the first ever shown of this jellyfish, and, in all probability, the first successful photograph of a living jellyfish of any kind. The tentacles of this specimen stretched away a whirled fluted mass, tinted a rich pink, folded flounced and fringed like twisted lace. Depending from the disk were numbers of long opal-hued tentacles, four only being shown in the photograph.

This specimen is a pigmy compared with some observed in these waters. Jellyfish with tentacles forty feet in length—veritable giants—have fouled the nets of the fishermen off the mouth of Avalon Bay. Doubtless this jellyfish sometimes attains great length. So vast are the numbers of jellyfishes at the time of writing—April—that in crossing the Santa Catalina channel they are almost constantly in view. The entire channel may be said to be filled with these living comets, which at night aid in converting the waters into a sea of light.

One of the most beautiful of all jellyfishes, and one not uncommonly seen here, has been kept in confinement by the writer. This is the Physophora hydrostatica. So far as the observation of the writer goes, it is the most rapid in its movements of all the jellyfishes. When the specimen mentioned was placed in a tank, it darted about with all the rapidity of a fish. In a short time it learned apparently that rapid movement would not avail and slowly swam about with fanciful, lacelike adornments and pendants, resembling an inverted thermometer more than anything else; for there is a central axis, which calls to mind the tube of the thermometer—it is elongated into a bulb at the upper portion and is filled with gas at the will of the animal.

This axis may be four or five inches in length. About it are numbers of transparent glass-like bodies (nectocalices) resembling individual jellyfishes, which are so delicately attached to the stem that they wave to and fro. They easily break off, and for a short time seem to possess life of their own.

These beautiful bodies are so many pumps, and are the organs of locomotion of the Physophora, forcing it along swiftly or slowly, as it pleases. At the base of the central column are groups of various organs, the most conspicuous resembling the tentacles of a sea-anemone, and colored a rich pink. Below them extends a maze of lacelike tentacles, lavender and pink in hue. The float is an exact imitation of a bulb of quicksilver.

The writer was fortunate in observing the Physophora in the act of descending. When captured its bulb was filled with gas and was half an inch in length—a float that kept the animal at the surface with the top of the bulb bobbing above it so charged; it was impossible for the creature to sink. It made several ineffectual efforts to do so, pumping itself a few inches below the surface; but the bulb would carry it up again. It now swam around several moments, then stopped in the center of the tank; the lower part of the bulb or float was seen to restrict, as though some one had tied a string about it. Presently the restriction reached the center, forming a separate drop of seeming quicksilver, which was gradually pushed downward by muscular action until it escaped and rose to the surface. Another restriction was now forming, and another drop of gas was pushed down and out of the tube of the mimic thermometer. This was repeated four or five times in ten minutes, and finally the beautiful and complex pumping machines forced the entire animal below the surface without difficulty.

Similar to the Physophora, but rarer in these waters, is the allied form, Agalmopis, two specimens of which it was the writer's good fortune to secure. In the open water it was a most delicate creature ablaze with color. So delicate was it that the slightest swirl of the water seemed to threaten it, and it was only taken by lowering beneath it a glass jar. Like Physophora, it has an axis which is covered with the glasslike pumping machines, or nectocalices, in two rows; all giving the upper portion of the animal the appearance of an elongated globe of glass. Each nectocalix, or pump, resembles a jellyfish in appearance, and is connected with the axis by a delicate stem and with its neighbors by gelatinous horns which become locked, giving the entire mass some stability. The crystal pumps have circular openings which lead to cavities within; all the openings point at right angles to the axis. As in Physophora, they are the organs of locomotion, water being taken in and violently forced out by the sudden compression of the walls of the crystal pump. The animal has the power to change the direction of the openings, and so its direction, to a certain extent.

It was fascinating to watch the evolutions of this beautiful creature and the peculiar movements of the nectocalices, leaping as the water was pumped out; but the "pumps" very soon broke away, and covered the bottom of the tank, each moving and turning about, apparently with a life of its own. Reaching out from this portion of the animal are groups of organs of various kinds and lacelike tentacles of rose pink.

With these delicate forms were kept for a short time

both physalia and velella members of the Siphonophora. The latter is very common in this latitude in August, coming with great regularity, being blown in on the prevailing west wind. The writer has seen the Santa Catalina channel so covered with these mimic craft, all sailing on the starboard tack, that the water so far as the eye could reach glistened with their satin leg of mutton sails. Nearly all which were examined held delicate shrimps in their short tentacles, while some had captured tiny fishes. Velella is a perfect raft with a horizontal sail always set; the hull, as it may be termed, is a mass of concentric compartments which communicate with one another, making so buoyant a disk that it never leaves the surface. On the upper side rises the glass-like sail, or frame, covered with a delicate blue membrane. On the lower surface the tentacles hang around a central mouth. A number of different appendages add to the interest of this animal ship. In some works it is figured beneath the surface, but this is impossible; the raft is always on the surface, with the sail set; and if a wind be blowing the velella is carried along over the sea, a mimic ship in every sense of the word, dragging its short tentacles, which seize and overpower small animals by the aid of the lasso darts they bear. Velella is harmless, but its ally Physalia, which is supported by a beautiful bubble, is one of the most dangerous of all the jellyfishes. The specimens observed in this portion of the Pacific were not over two inches and a half in length; but in the Gulf of Mexico they appear to attain their maximum size of five or six inches, with tentacles from ten to thirty feet in length. The sail when retracted is a simple ridge; but when physalia wishes to move it elevates a crumpled mass of pink-tinted satin and a sail is seen extending the entire length of the bubble, an effective organ of locomotion in a good breeze, the movement tending to bring the tentacles to within a foot of the surface, these poisonous, and indeed deadly, organs to fishes, being towed along as would a fisherman's bait. Small fry bite at them, and so virulent is the poison that they roll over dead, when they are hauled up to be absorbed by the body mass.

The most interesting feature of the jellyfishes, taking the one shown in the accompanying illustration as a type, is their development. Late in the summer yellow masses are seen through the disk; these are the eggs, particularly noticeable in the common Cyanea. The first stage of the latter is carried about in the mouth folds of the parent, and is then known as the panula, a minute elongated spherical body covered with cilia or hair-like organs. It now escapes and assumes a pear shape and becomes fixed to the bottom at one end. The upper or free portion now appears to divide, and small tentacles are seen, the object resembling a small hydra. This upper portion in the jellyfish Aurelia now seems to divide itself up into a series of fringed platters, which break off, become distinct jellyfishes, and so swim away.

"Scorching."

A sad story appeared in The New York Times of June 11. A young bicyclist was running a race with a trolley car. When he showed signs of tiring, the jeers of the men on the car spurred him to renewed effort, which was further encouraged by the favoring smiles of the ladies at his renewed efforts. Then came the tragedy. The onlookers, sitting at their ease in the car and themselves risking nothing, "saw him regain what he had lost, go forward. * * * Blood was pouring from mouth, ears and nostrils, and he was badly cut and scratched"—and dead! No wonder that the reporter has occasion to add that, after the part they had played as unintentional causes in this tragedy, "the young men and the young women slowly returned to their car. The young men did not jeer again. The young women had no heart to smile." This principle of "record-breaking" and of insatiable attempts to outdo others is the bane of the age. It is urged that it is the very life of progress. We do not think so. There would be just as much real progress—nay, more—in all careers of life if men would leave off pitting themselves so eternally against each other and put themselves instead against their own best without regard to what others might have done or be doing. Let each man strive in every walk and relation of life to attain the best of which he is capable, with due regard to the harmony of his own best interests, and let him neither mind if he is distanced by others on the one hand, nor be satisfied though he beat all the world on the other, yet fall short of the standard of his own capabilities. So will the harmonious progress of the race be better assured than by all the "record-breaking" and "scorching" possible.—The Sanitarian.

Septic Skirts.

The streets of our great cities are not kept as clean as they should be, and probably they will not be kept scrupulously clean until automobiles have entirely replaced horse-drawn vehicles. The pavement is also subjected to pollution in many ways, as from expectoration, etc. Enough has been said to indicate the source and nature of some of the most prevalent of nuisances of the streets and pavements, and it will be generally admitted that under the present conditions of life a certain amount of such pollution must exist, but it does not necessarily follow that this shall be brought indoors. At the present time a large number of women sweep through the streets with their skirts and bring with them, wherever they go, the abominable filth which they have taken up, which is by courtesy called "dust." Various devices have been tried to keep dresses from dragging, but most of them have been unsuccessful. The management of a long gown is a difficult matter, and the habit has arisen of seizing the upper part of the skirt and holding it in a bunch. This practice can be commended neither from a physiological nor from an artistic point of view. Fortunately, the short skirt is coming into fashion, and the medical journals especially commend the sensible walking gown which is now being quite generally adopted. These skirts will prevent the importation into private houses of pathogenic microbes.

The Current Supplement.

The current SUPPLEMENT has an unusually large number of interesting articles. "The New Waterworks Extension in Glasgow" is by J. A. Stewart. "Iron and Steel Rails in America" is by Robert W. Hunt. "American Engineering Competition, V." deals with ore supplies and transportation. "Persia and Its Capital City" is an elaborately illustrated article. "Some of the Resources of the Philippines" is by G. D. Rice. "Panoramas of the Exposition of 1900" deals with the Stereorama and the trans-Siberian panoramas. "The Reaction Breakwater as Proposed for the Opening of the Southwest Pass of the Mississippi River" is by Prof. Louis M. Haupt.

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RECENTLY PATENTED INVENTIONS.

Bicycle Attachments.

BICYCLE-LAMP HOLDER.—EUGENE E. HENRY, Stamps, Ark. In this lamp-holder is found a new departure in a very simple and ingenious contrivance by which, when the rider is about to turn a corner, the lamp is swung around faster and to a greater extent than the fork is turned. The lamp-bracket is mounted to turn in a frame or support clamped to the fork, and small chains extend from the lamp-bracket to the steering-head, the arrangement being such that, in addition to swinging with the fork, the lamp-bracket turns on its own axis to throw the light around the corner.

BICYCLE-SUPPORT. — HUGH H. COOTE, Phœnix, Ariz. This support is of the type which may be carried on the bicycle, and the legs thrown down by springs, when it is desired to support the wheel. The novelty lies in the general construction and arrangement, which the inventor has designed with a view to decrease weight and promote convenience in adjusting the support.

Electrical Apparatus.

ELECTRIC SIGNAL AND FIRE-ALARM.—DAVID GEYWITS, Rome, N. Y., and WILLIAM STILL, Utica, N. Y. This invention merits the consideration of hotel men. It provides for awakening guests at the hours requested, the receiving of an answering ring from the guest to avoid disputes, the automatic sounding of an alarm at the hotel office in case of fire in any of the rooms, and permits the sounding from the office of an alarm in each room in case of fire. At the office a clock and a switch system are provided so that a pin inserted to correspond with a given hour and a given room will cause the clock to ring the bell in the guest's room. In the absence of an answering ring from the guest, the signal may be repeated. If a fire occurs in any room, a thermostatic circuit closer sounds an alarm at the office. A single switch device enables the hotel clerk to alarm the guests in all the rooms at once, in case of fire.

ELECTRIC ARC-LAMP. — JAMES E. DAVIDSON, Butte, Mont. In the new lamp devised by this inventor, there are disclosed a number of important improvements to a full understanding of which a copy of the patent should be examined. The carbons are prevented from "bucking" or bobbing up and down; a slight movement of the armature of the regulating magnet imparts, through special connections, an increased throw to the carbon so that the movements of the latter are much more sensitive, and a means is provided which is designed to make the burning out of the magnets impossible.

TROLLEY-HARP.—EDWARD G. JOHNSON, Brigantine, N. J. Instead of mounting the trolley-wheel in a fixed position on its shaft, as usual, the harp mentioned permits the wheel to slide on its shaft in order to follow the conductor, as in turning a curve, and springs are provided on the shaft, at each side of the wheel, which return the latter to the normal position.

Industrial Arts.

APPARATUS FOR CUTTING GLUE. — CARL WOLFF, New York city, N. Y. An automatic machine, having this title is noticeable for the arrangement of knives, the belts which feed the blocks of glue and the belts for carrying the cut slices to the dryer or elsewhere. Parallel knives have their edges facing upward, one projecting above another in step form, and the vertical runs of two belts grip the blocks of glue or gelatine and feed them forcibly to the knives. From the base of each knife a separate downwardly inclined conveyor belt is arranged the belts running one above another and of different lengths, all terminating adjacent to a horizontal conveyor which may lead to a dryer.

DUST COLLECTOR.—LOUIS C. MEYEROTT, Evansville, Ills. The important adjunct of the dust collector, in modern flour mills, to collect and dispose of the flour dust in the air, is the subject of constant improvement. A type of apparatus for this purpose consists of frames or drums covered with cloth through which the air is passed. The one referred to above includes a horizontal drum in which separate compartments are formed by the cloth, the compartments being collapsible and as each in its turn comes uppermost, its sides are collapsed by a cam and then suddenly forced outward by a spring to jar the cloth and free it of the dust, which then falls into a trough having a conveyor screw.

CALCINING FURNACE.—GODFREY HUGHES, El Paso, Texas. This patent relates to ore calcining furnaces and discloses a novel manner of passing the ore through the calcining flume or chute. The latter is inclined and has a series of dumping plates, which are acted on by a traveling chain having trips. The ore is received, from an elevator, on the top and falls step by step to successive plates. The flames from the furnace rising through the chute serve to thoroughly calcine the ore by the time the latter has reached the outlet provided at the bottom. The rapidity of the travel of the ore may be regulated as required.

Railway Cars and Appliances.

RAILWAY-CAR.—THOMAS L. STATE, Detroit, Mich. A car, patented by this inventor, is provided with two floors, the lower one comprising a parlor, reception room, state-rooms, etc., and the upper one arranged with sleeping berths and baggage compartments. The improvements comprise, besides the general features referred to, a special arrangement of the sills and transoms, as well as a new form of convertible seat.

DOOR HANGER AND TACK THEREFORE. — JOHN C. GABEL, JR., Onarga, Ills. This inventor has patented a door hanger and tracks of the class in which provision is made for moving the door laterally into the door opening in addition to the longitudinal sliding movement. In the opening and closing of the door, only a longitudinal pressure is necessary, the track and hanger serving to guide the door into and out of the opening.

RETAINING VALVE. — JOSEPH S. LAPISH, Salt Lake City, Utah. As an improvement on a prior patent relating to the same subject, this inventor has patented a new form of retainer valve for retaining the air pressure in the brake cylinder while the auxiliary reservoir is being recharged, and the new form is so arranged that no waste of air can occur in the supplying of air to the retainer cylinder and the operations of controlling the leak port.

CAR COUPLING. — MARK A. BROWN, Douglas, Ga. A car coupling out of the conventional lines is the subject of a patent to this inventor. He employs on one car a coupling hook having an arrowhead at one end, and this is engaged by peculiar spring retainers on the opposite car, which are stated to be effective in preventing uncoupling on curves. The hook is made reversible and may co-act with an ordinary link and pin coupling.

Steam, Gas and Lighting.

BOILER-FEEDER.—HENRY J. DAVIS and others, Birmingham, Ala. This apparatus is automatic in its action and maintains the water level at any predetermined height. A chamber in communication with the boiler contains a float which falls as the water level lowers and permits entrance of water to the chamber by first controlling the entrance of steam to the water chamber and then exhausting the steam to reduce the pressure in the water pipes and thus permit the inflow of water. The rising of the float by the charge of water in the water chamber acts to admit steam from the boiler, equalizing the pressure and causing the water to flow into the boiler by gravity.

GAS BURNER.—MICHAEL B. CARMODY, Zanesville, Ohio. This invention is noticeable in providing a feature of marked improvement in fuel-gas-burners, for the purpose of regulating the gas supply in the interest of efficiency and economy. The gas supply pipe delivers to a gas chamber divided into compartments and the mixing tube for the air and gas is similarly divided. Thus gas from one compartment and its complement of air may be delivered to the burner, or two or more compartments may be utilized according to the heat required. The invention is also designed to prevent the flame from running back ir the mixing chamber.

CALCIUM-WICK LAMP. — ANDREW PLECHER, Savannah, Ga. A new type of lamp has been patented of this inventor. The light is produced by a lime wick or tube which draws up the oil by capillary action, and oxygen gas which is caused to issue from a perforated ring and impinge against the wick, the burning of the oil causing the incombustible lime wick to glow with a brilliant incandescence.

LAMP BURNER.—WILLIAM HARRIS, Mound Bayou, Miss. This inventor arranges a pressure strip to be pressed by a set screw against the wick of a burner, to hold the wick securely, and also with the object of limiting the amount of oil consumed and enabling the lamp to burn without a chimney if desired. The invention is mainly intended for signal and railway lanterns which are required to burn a long time without being charged.

Mechanical Devices.

COTTON-PRESS. — SILAMON MCLEAN, Bingham, S. C. The development of the roller cotton-press is one of the comparatively recent fields inviting the American inventor, and true to his reputation he confines himself here as with other mechanical problems to no set lines, but endeavors to produce various embodiments of the principle involved. In the McLean press the cotton is fed through the feed rollers into a baling box which oscillates beneath a series of rollers arranged in the arc of a circle, so that the cotton is compressed in layers. The follower of the box is carried by a screw, mechanism being provided to turn the screw and cause the follower to recede gradually as the bale is formed. A very ingenious feature is a means for automatically governing the follower in its descent according to the pressure of the bale.

PERFORATOR.—GUSTAVUS A. EVANS, Nelson, B. C., Canada. In the practical operation of perforating attachments of job printing presses difficulty is not infrequently experienced in insuring a proper register of the punches with the perforations in the bed piece, in freeing the perforated sheets, and in preventing accumulation of the punched particles in the bed piece. To remedy the defects, the present patentee modifies the punch bar and bed piece so that the former is properly guided and yieldingly engages the bed piece; he provides a novel clearing bar which first presses on the paper to clamp it securely, then yields to permit the punches to pass, and, as the punches withdraw, the bar acts to dislodge the sheet from the punch bar. The punched particles enter a groove having its ends so formed as to permit the particles to free themselves.

MECHANICAL MOTOR.—GEORGE S. ZENT, Little River, Kans. This motor is of that class in which a descending weight operates a train of gearing, and the improvements provide a special transmitting and regulating mechanism for applying the power of the motor by means of a walking-beam to operate two pumps or similar devices.

POWER-MACHINE.—DAVID W. REYNARD, Morris, Pa. For driving bicycles or other machines, this inventor has patented an apparatus in which he employs the principle of two hand or foot levers at opposite sides of the machine to be alternately pressed downward. The special transmitting mechanism is designed to avoid dead centers and effectively apply the power.

Miscellaneous Inventions.

ATTACHMENT FOR FEED BAGS.—HENRY BARK, Yonkers, N. Y. In the different attempts to prevent waste of oats from a feed-bag by the horse tossing his head, the bag itself has been variously modified. The inventor above referred to employs the ordinary bag, suspended as usual, and provides a crescent-shaped guard to be secured to the extreme upper end of the bag, at the back, the front of the crescent having a strap to go around the horse's nose.

TOY MUSICAL INSTRUMENT.—ROBERT PITT, St. Lewis, N. C. This inventor has produced a new form of musical toy, into which air is blown through a tube at the side and causes a loud musical sound by means of two specially constructed perforated diaphragms at the ends of the instrument.

TRUNK-HANDLE.—BERTNIE M. WHITE and FRANK A. HOYT, Gordon, Neb. In the handling of trunks, the

pinching of the fingers between the handle and the trunk body is frequently experienced. To prevent this, the handle above noted is so connected by its ends that when gripped it slides outward in diagonal slots in the securing devices and so as to stand out from the trunk body.

FURNITURE-SPRING.—EDWARD A. SEABURG, Seattle, Wash. A system of springs devised by this inventor provides a series of supporting springs in square arch form, and a superposed series of standards resting on the springs and connected together at the top by webbing.

BANANA-CRATE.—ANTONIO and JOHN SANSONE, Keokuk, Iowa. For shipping bunch bananas and also other fruit, the above-mentioned crate affords a safeguard against injury to the fruit by providing an outer frame and an interior suspended bag, which is spaced from the rigid frame and centered by circular series of flexible connections with the frame at different points.

BRACELET.—WILLIAM F. SIMON. West Hoboken, N. J. The improvements in articles of jewelry keep apace with other devices and reflect the universal tendency to embody new mechanical ideas. In a bracelet patented by this inventor, a strip of metal is crimped or corrugated and coiled spirally, whereby new ornamental effects are produced and increased flexibility obtained.

TRAP. — THOMAS H. TAYLOR. Luzerne, Pa. This trap is designed to kill small animals instantly, and to this end the inventor provides a pivoted bait plate with one end turned up to form a jaw, and a spring frame which, when the trap closes, will spring downward, striking the animal and causing it to be caught between the frame and the jaw of the bait-plate.

POST HOLE DIGGER. — JAMES L. CATES, Senatobia, Miss. On the post-hole digger patented by this inventor the shank has a special socket for receiving a detachable handle which has a peculiar shape to enable it to be used as a wire-stretcher.

Designs.

PUMP-BASE. — ARTHUR E. HUNT, Nichols, N. Y. In this pump-base an interior tubular extension rises from the inlet opening at one side of the center and the outlet opening is at the top at the opposite side. The sand, etc , thus has an opportunity to settle.

FIREPLACE REGULATING-PLATE. — HENRY PANNILL, Petersburg, Va. This patent presents a new design for plates for regulating the draft in fireplaces, the plate being rectangular in form, corrugated from end to end, and scalloped in three of its edges, elongated slots being formed in the plate for use in connection with a suitable damper-plate.

ANTI-RATTLER FOR THILL-COUPLINGS.—WILLIAM H. PARDEE, Antigo, Wis. The device patented by this inventor is intended for use in connection with the wire anti-rattlers, and shows a new shape of the bearing block.

ELECTRIC-LAMP HOLDER. — WILLIAM ROCHE, Jersey City, N. J. A novel campaign novelty has been patented by this inventor, consisting of a cup-shaped holder for a small electric lamp, the holder having an attaching pin, and at the front of the cup the portrait of a political candidate may be placed.

RECEPTACLE.—FRANK F. HOLLAND, Portland, Me. This design relates mainly to a unique shape of metallic ice cream cup to be used at soda fountains in connection with the popular handled holders.

FABRIC-TRIMMING. — THEODORE SCHIESS, New York city. This inventor has patented a new design of edging for trimming, the distinguishing feature of which is a zigzag line of stitching at each side, with tufts and knots at the outer connecting points.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

FLASHES OF WIT AND HUMOR. By Robert Waters. New York: Edgar S. Werner Publishing and Supply Company. 1900. 12mo. Pp. 186. Price $1.

Mr. Waters has written a merry little book in which is attractively presented the humor of the world's cleverest men. He has sometimes missed the point of a good story and sometimes failed properly to translate the sayings of foreign wits. On pages 33 and 120, the French adage, "*Qui se ressemble s'assemble*" has been misquoted, an error that might have been avoided by employing the good English proverb, "Birds of a feather flock together." On page 53, the pun on Napoleon's name, "non tutti, ma buona parte," uttered in reply to the statement, "all Italians are perfidious," has been incorrectly translated "not all, my good fellow," instead of "not all, but a good part," thus missing the point entirely. These are only trifles, hardly noticeable among a host of clever sayings.

TOPOGRAPHIC SURVEYING. INCLUDING GEOGRAPHIC, EXPLORATORY, AND MILITARY MAPPING. By Herbert M. Wilson. New York: John Wiley & Sons. 1900. Octavo. Pp. xxx. and 900. Price, $3.50.

The book contains, in concise form, all the data necessary to a knowledge of topographic surveying. The methods elaborated are chiefly those developed in recent years by the great government surveying expeditions. The work will be of assistance to the engineer who may be called upon to conduct an exploratory survey in an unknown region, or to make a detailed photographic map as a preliminary to construction. Descriptions and examples of the methods to be employed and the essential tables required in computation are included in the volume.

LE GRANDE EPITOME. A Fundamental Principle and its Immediate Facts Relating Man to the World. A Sequence. By C. A. Bowsher. 16mo. Pp. 19.

Business and Personal.

Marine Iron Works. Chicago Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Most durable, convenient Metal Workers' Crayon is made by D. M. Steward Mfg. Co., Chattanooga, Tenn.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., Spring and Varick Sts., N. Y.

Ferracute Machine Co., Bridgeton, N. J., U. S. A. Full line of Presses, Dies, and other Sheet Metal Machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7936) M. S. asks how to stop cross talk on two grounded lines running parallel for six miles. A. The complete remedy for cross talk on a grounded circuit is to remove the ground and put up a complete metallic circuit properly crossed. If this is not feasible the common return system may be used, which will save wire. In this system a single return wire is made to serve for all the lines on the poles. You will find the various methods of putting these up described in Miller's "American Telephone Practice," which we can furnish you for $3 by mail, and which should be in the hands of every telephone man.

(7937) A. M. W. writes: Is an undershot waterwheel placed between two floats, in a ten mile an hour current practical to run a pump for sprinkling garden and lawn, water to be elevated thirty feet? Would two floats twelve inches square and twelve feet long made of plank, and securely fastened at right distances apart at each end to allow the wheel to run between them, have buoyancy enough to hold the wheel and pump? Can you advise me of anything published on the subject or give me any information as to size of wheel or pump the most practical? A. The float as described with a light wheel 5 feet diameter working directly on the pump from its crank, will supply a large quantity of water for garden irrigation at the elevation stated. A 5 foot wheel should make 30 revolutions per minute and operate a pump 1½ inches diameter by 5 inches stroke double acting and should pump 2 gallons per minute 30 feet high. Wheel should be 3 feet wide, buckets 8 inches wide. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 799, on "Current Wheels and Raising Water," 10 cents mailed.

(7938) A. L. N. asks: 1 As an electric motor in fact is a magnetic motor, and as the strength of a magnet decreases as the square of the distance, would not an electric motor be more efficient less the air gap was made, only to insure free running of the armature? Would not the same prove true regarding dynamos also? A. The armatures of all dynamos and motors are made to run with as narrow an air gap as possible. This is because so much is lost in forcing the "lines of force" through the air. They flow through iron with much greater ease. 2. What kind of metal would be best to use in an electrophorus with a disk of resin ½ inch thick and 12 inches diameter? A. Any kind of metal can be used as a plate of an electrophorus. Tinned sheet iron is good. 3. Is an electric current in the science of to-day considered to be a vibration of the molecules of the conductor or what? A. An electric current is believed to be a disturbance of the ether of space. 4. If sufficient head could be procured to fuse carbon, would it crystallize and become diamonds? A. Carbon has been fused and vaporized. It becomes carbon again when it cools. It is believed that enormous pressure is needed to enable carbon to become diamond. 5. As an electric current under certain circumstances causes matter to be lighter or in other words, diminish the attraction of the earth on some, would it not be practicable to utilize said action to overcome gravitation say in airships? A. If an electric current can overcome gravity it might be used to lift an airship. 6. Is there more than one kind of electricity? It must be, because the behavior of sparks from a running belt, a battery, or a dynamo seems to be as different to each other as different fluids or gases. A. There is only one electricity. 7. If gold can be separated to simply copper and lead, can not said metals be combined to make gold? A. If gold can be separated into copper and lead, these metals could be combined into gold. 8. What is auric acid, and how is it made? A. We do not know what auric acid is. 9. Can a body be dissolved or separated to its elements, said elements sent by an electric wire to another place and then reassembled? A. We do not know any instance in which a body has been decomposed by electricity and its elements sent to another place to be reassembled again by the same power.

(7939) L. R. D. asks: 1. Could an electrical current of a high voltage, but of a low amperage be connected to one of a high amperage, to form a current of a high voltage and a high amperage. A. No. 2. Could two motors be connected in series each ½ the voltage but all the amperage. A. Yes. if direct current is used. 3. What size wire should I use on 2 pole armature Edison dynamo to obtain the highest amperage? I am not particular about the voltage; should it be shunt wound? A. The little machine is wound in all probability to the best advantage as it is. It is a motor, and will not probably act as a dynamo unless you use a battery to excite the fields.

TO INVENTORS.

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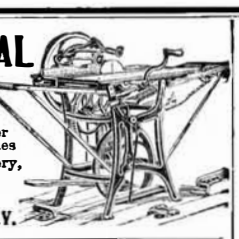

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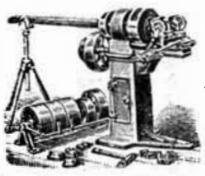

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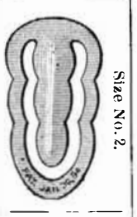

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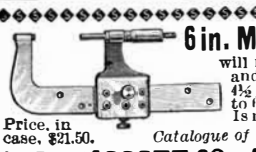

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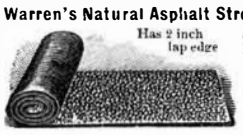

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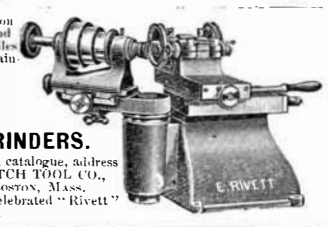

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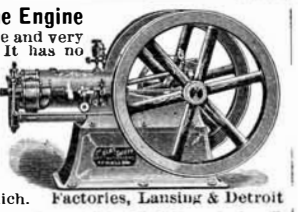

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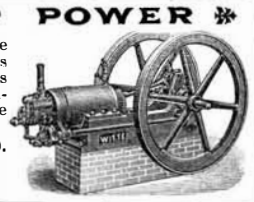

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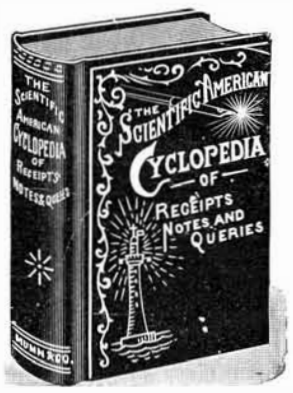

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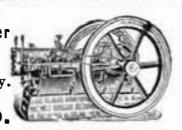

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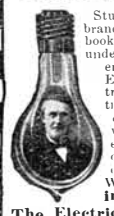

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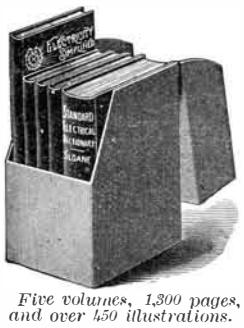

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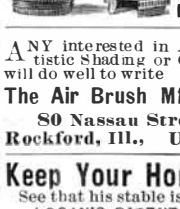

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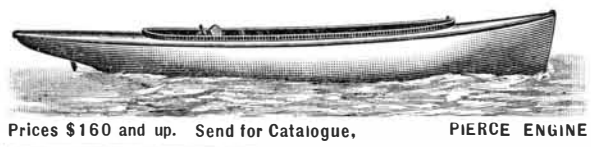

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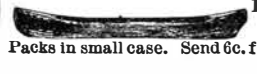

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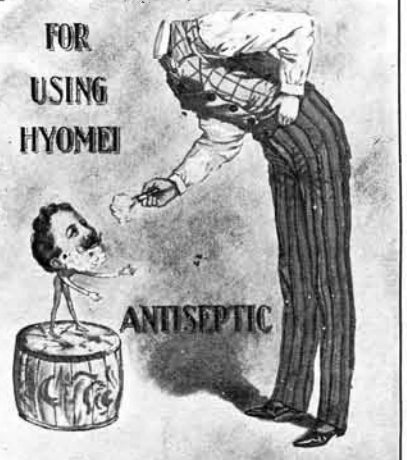

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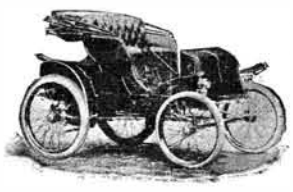

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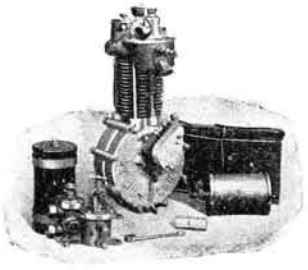

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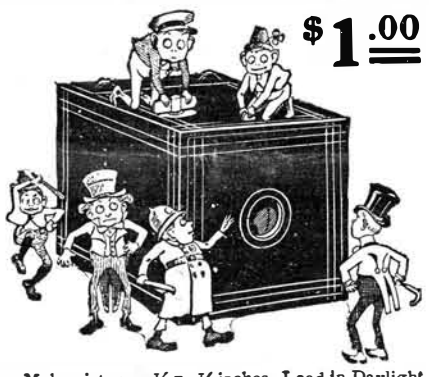

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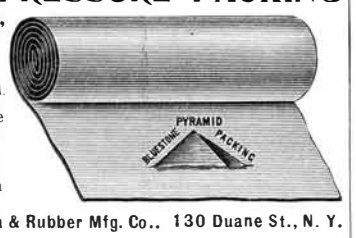

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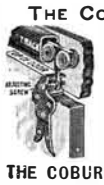

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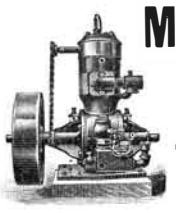

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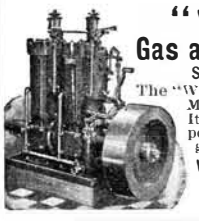

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